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Static Tests of Excess Ground Attenuation at Wallops Flight Center

Louis C. Sutherland and Ron Brown

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Static Tests of Excess Ground Attenuation at Wallops Flight Center

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1.0 INTRODUCTION

The aircraft acoustics community is currently very concerned about developing a firm basis for accurately predicting aircraft sound propagation losses for routine application to aircraft/airport noise evaluation. The most important area requiring clarification is concerned with the attenuation in excess of spreading and air absorption losses which occur for propagation at near grazing incidence with the ground. The dominant cause of this excess attenuation, called excess ground attenuation (EGA), is attributed to a complex interaction between sound waves over and in a partially absorbing ground.[1, 2] A major aspect of EGA is its variation with elevation angle. Data from aircraft flyby measurements, recently developed by members of a subcommittee of the SAE A-21 Committee on Aircraft Noise, show that measured values of excess attenuation for propagation to the side of an aircraft vary substantially with elevation angle. However, these attenuation data include the potential effect of other factors such as refraction by a nonuniform atmosphere, diffraction or shielding of aircraft noise by the aircraft engine/structure configuration, scattering by atmospheric turbulence and possible nonlinear attenuation losses. It was desirable therefore to provide improved experimental verification of EGA under weather conditions using an isolated, static, relatively low level, source which would minimize the influence of these other effects. This report represents the results of a program designed to augment such a data base. While refraction effects could not, of course, be entirely eliminated, the data were taken under conditions of very low wind speeds (averaging about 1 m/s) and, for the majority of the ests, with a slightly positive temperature gradient which prevented acoustic shadow formations in the direction of the sound propagation.

Available theory, as recently summarized by Pao, Wenzel and Oncley,[1] defines the ubstantial excess attenuation due to ground absorption expected in the mid-audio requencies for very low ($< 10^\circ$) elevation angles. The test program described in this document was designed to provide a static replication of a recent NASA flight test with a T-38A aircraft which evaluated this phenomenon.[3] Hence this test program was devoted rimarily to the measurement of steady state propagation losses at near grazing incidence ver the ground.

1.1 Program Objectives and Results

The program involved the measurement of mean noise levels for single frequency bands of noise from 50 to 4000 Hz for a source on an elevating 10 m tower out to distances of about 700 meters. The test signal consisted of a series of one-third octave bands of noise, each produced one at a time for a period of 20 seconds, at selected intervals based on weather.

Throughout the program, emphasis was placed on evaluating the average excess ground attenuation as a function of elevation angle, distance and frequency for comparison with the T-38A flight test data. It was not feasible to attempt a static test program which replicated the full range of all three of these variables. However, it was possible to replicate a major portion of the experimental range of elevation angles and frequencies involved in the T-38A program.

Following this introduction, the next section briefly describes the technical background for the test program. The emaining sections then describe:

- the test site and microphone positions (Section 3.1)
- the acoustic measurement system and related test procedures (Section 3.2)
- the weather measurement system and related test procedures (Section 3.3)
- the acoustic and weather data analysis system and analysis procedures (Section 3.4)

and, finally, the results in terms of:

- weather conditions during the test (Section 4.1)
- measured excess attenuation values as a function of distance, frequency, elevation angle, and ground surface (Section 4.2)
- brief results on measurements of acoustic ground impedance at the site (Section 4.3), and
- limited results on propagation fluctuations (Section 4.4).

For a quick overview of the principal results, the reader is referred to Figure 7, page 22, which illustrates the test geometry, Figure 24, page 77, which portrays the average weather conditions, and Figure 29(a) through 29(j), pages 82 through 91, and

Figure 31, on page 96, which illustrate the principal findings concerning excess ground attenuation.

A brief discussion of the results is presented at the end, in Section 5.

Use of trade names or names of manufacturers in this report does not constitute an official endorsement of such products or manufacturers, either expressed or implied, by the National Aeronautics and Space Administration.

2.0 TECHNICAL BACKGROUND FOR TEST PROGRAM

Three factors guided the planning and execution of this test program:

- The expected trends in excess ground attenuation for ideal weather conditions (isothermal, still atmosphere) based on theoretical considerations,
- The desire to replicate, to the extent possible, the test conditions for the T-38A test program described in Reference 3, and
- The expected trends in excess attenuation based on previous experimental data for near horizontal sound propagation in real weather conditions.

These factors are briefly considered in this section as they relate to this measurement program.

2.1 Theoretical Background for Design of the EGA Measurement Configuration

A basic expression which can be used to define EGA is given by the following equation for the change (call it A_e) in free-field level when a given point source-receiver path is bounded by an infinite and partially absorbing ground plane[1, 4] (see Figure 1).

$$A_e = 10 \log \left[1 + \left(\frac{r_1}{r_2} \right)^2 \left| Q \right|^2 + 2 \frac{r_1}{r_2} \left| Q \right| C(\omega) \cos \left[k_1 (r_1 - r_2) + \alpha \right] \right] \quad ,\text{dB} \qquad (1)$$

where

r_1, r_2 = the direct and reflected path lengths, m

$Q \exp(i\alpha)$ = the complex image source strength, relative to the direct signal, which can be used to represent the reflected signal,

k_1 = wave number $(2\pi/\lambda)$ in the atmosphere, m^{-1}

$C(\omega)$ = coherence coefficient between direct and reflected signals.

Based on the analytical development in References 1 to 7, it can be shown that this excess attenuation depends on the following set of parameters for typical situations where the source and receiver are separated by at least a few wavelengths.

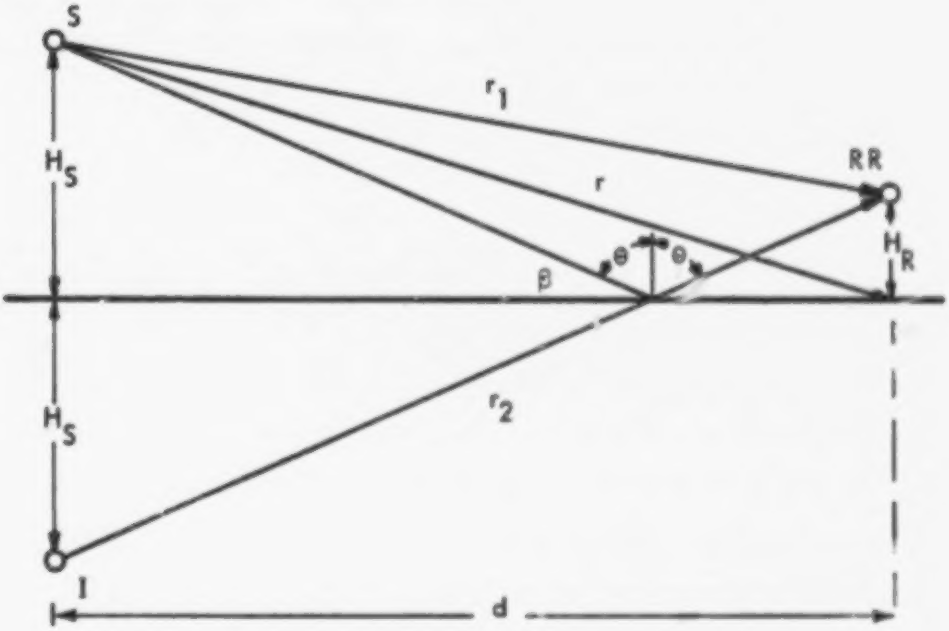

S
r_1
RR
H_S
r
θ
θ
H_R
β
r_2
H_S
I
d

Figure 1. Ground Effect Geometry (Reference 4).

$$A_e = \text{Function of } \left[(f\, d/c), (H_S+H_R)/d, (f\, H_S H_R/dc), (f/\sigma)\right] \quad (2)$$

where

f = the signal frequency,

c = the speed of sound in air,

σ = the specific flow resistance of the ground surface,

and H_S, H_R and d are the heights of the source and receiver and their horizontal separation distance as shown in Figure 1.

If one EGA experiment is to duplicate the values from another experiment, each of these parametric groups must remain the same.

If it were not for the last group (f/σ), which governs the variation in acoustic impedance and propagation constant of the ground,[5, 6, 7] it would be possible to employ pure geometric scaling to duplicate one EGA experiment by another. In this case, distances in the scale model experiment would be equal to full scale values divided by a scale factor S and frequencies measured in the scale model experiment would be multiplied by the same scale factor.

While such a scaling approach to experimental investigations in other types of geometrical acoustics problems is well known, it was not applicable here since the critical ground impedance parameter cannot be scaled in situ. Thus, geometric scaling was not feasible for this program.

Only one other variation is possible which retains the same values of the parameters defined in Eq.(2). Since the geometrical parameters vary as both the sum (H_S+H_R) and product ($H_S \cdot H_R$) of the source and receiver heights, there is no other variation in geometry possible, providing one can't scale dimensions, except to simply interchange these two heights.

For example, if one wished to replicate the EGA values, in a static experiment, from an aircraft flyover at altitude H_S measured with microphones at height H_R, it would be possible, according to the theory, to duplicate the static equivalent of the flight tests by maintaining the same source-receiver path lengths and by reversing the source and receiver positions, - that is, placing the source for the static test at the receiver height H_R and the microphone for the static test at the aircraft height H_S.

This approach was not considered practical for this program for two reasons:

1. It would have been practical to mount a microphone at elevations simulating only the lowest aircraft altitudes involved in the T-38A tests (9 and 18 meters).[3]

2. There is a good reason to expect that excess attenuation from scattering by turbulence in the atmosphere, even though it was minimized by careful selection of weather conditions, would not be identical for a ground to air path as for an air to ground path,[8] so that the theoretical possibility of reversing the position of source and receiver would not have been valid in practice.

2.2 Replication of the T-38A Test Program

Based on the preceding considerations, the strategy selected for this test program was to either duplicate or cover as much of the same range as possible of the four parameter groups in Eq. (2) by matching the following variables as they occurred in the T-38A program.[3]

o	Grazing Angle, β	(0.28^{o} to about 36^{o}) (duplicating this angle is equivalent to duplicating the ratio $(H_S+H_R)/d$), which is the second parametric group in Eq. (2), since $\beta = \tan^{-1} (H_S+H_R)/d$),
o	Frequency, f	(50 to 4000 Hz) (the same frequency range is employed in both tests),
o	Flow Resistance, σ	(inherently duplicated by using the same ground surface as for the T-38A program).

- The source-receiver path lengths (approximated by the microphone/ground track offset distances, d, of 231 to 1852 m)

If these four variables could be duplicated, then three of the four parametric groups in Eq. (2) would be matched. This leaves the one remaining parameter group fH_SH_R/d, or more precisely, the nondimensional group $H_SH_R/d\lambda$, as potentially unmatched for the full range of values encountered for the T-38A program. This potential shortcoming is unavoidable due to the necessity of using a lower limit for the source height, H_S (about 10 m maximum instead of 136 m) and a lower limit on the maximum horizontal separation, d, of the source and receiver (675 m instead of 1852 m). Thus, as a compromise, a scaled-down set of values of the separation distance d was employed. However, as pointed out earlier, this does not achieve true geometric scaling, since frequency is not scaled. Nevertheless, by using the scaled down values of separation distance, d, fH_SH_R/d, can be matched, in part, to the corresponding range for the T-38A test.

That is, for the same frequency, f, and microphone (receiver) height, H_R, for the two programs, a reduced source height can be matched to a reduced separation distance to maintain approximately the same ratio H_S/d and hence maintain the quantity fH_SH_R/d approximately the same. This geometric parameter group can also be conveniently used to define the frequency f_{max} for maximum destructive interference, of the received signal, assuming the ground were rigid. In this case,

$$f_{max} = c/2\,(r_1 - r_2) \simeq c\,d/4\,(H_SH_R) \qquad \text{for } (H_R+H_R) << d.$$

Thus, matching fH_SH_R/d is equivalent to matching the ratio of the driving frequency f to the frequency of maximum destructive interference for a rigid ground f_{max}.

Following this rationale, a two-step approach was selected to guide final selection of the static test geometry. First, it was felt that the range covered in the T-38A test by the two parameters, grazing angle β and f_{max} should be duplicated. Duplicating the grazing angle β over the same medium should ensure a good match to the actual frequency of maximum excess ground attenuation due to interaction of the air and ground waves.[9] Duplicating f_{max} should ensure a good match to the actual frequency of maximum excess attenuation due to the destructive interference of the direct and reflected sound waves.[9] Second, the horizontal separation of the source and receiver should be replicated in full scale to the extent possible. When this was not possible, then we relied on matching the other two parameters β and f_{max} (i.e., H_S+H_R/d and H_SH_R/d) to simulate, in the static tests, the critical EGA parameters for the T-38A test program.

2.2.1 Duplicating Elevation Angle β and Frequency of Maximum Interference, f_{max}

The values for β and f_{max} encountered in the T-38A program are tabulated in Table 1 and are plotted in Figure 2. The unexpected lack of "scatter" in this figure can be explained as follows.

Table 1

Summary of Elevation Angle at Reflection and Theoretical Frequencies for Maximum Interference from Ground Reflection (with Rigid Ground Plane) for T-38A Tests

Mic. Ht. m	Source Ht. m	d, Horizontal Source-Receiver Separation (Meters)							
		231	463	694	926	1158	1389	1620	1852
		β, Elevation Angle at Reflection, Degrees							
0	9	2.23	-	-	-	-	-	-	0.28
	18	4.76	-	-	-	-	-	-	0.56
	36	8.86	-	-	-	-	-	-	1.15
	73	17.5	-	-	-	-	-	-	2.26
	136	30.5	-	-	-	-	-	-	4.20
1.2	9	2.53	1.26	0.84*	0.63*	0.50*	0.42*	0.36*	0.32*
	18	4.75	2.37	1.58	1.19	0.95	0.79*	0.68*	0.59*
	36	9.15	4.59	3.07	2.30	1.84	1.53	1.32	1.15
	73	17.81	9.10	6.10	4.58	3.67	3.06	2.63	2.3
	136	30.7	16.5	11.2	8.43	6.76	5.64	4.84	4.24
10	9	4.70	-	-	-	-	-	-	0.59
	18	6.91	-	-	-	-	-	-	0.87
	36	11.33	-	-	-	-	-	-	1.42
	73	19.8*	-	-	-	-	-	-	2.57
	136	32.3*	-	-	-	-	-	-	4.51
		f_{max}, Frequency for Maximum Interference (Rigid Ground), Hz							
1.2	9	1824	3654	*	*	*	*	*	*
	18	914	1828	2739	3654	4569	*	*	*
	36	461	916	1371	1828	2286	2741	3197	3654
	73	236	456	679	904	1129	1353	1578	1803
	136	140	252	369	489	609	729	849	976
10	9	219	-	-	-	-	-	-	1754
	18	110	-	-	-	-	-	-	877
	36	55	-	-	-	-	-	-	438
	73	*	-	-	-	-	-	-	216
	136	*	-	-	-	-	-	-	116

- Indicates this combination of H, h, and d not used in T-38A program.

* Frequency of maximum interference outside range of 50 to 4000 Hz.

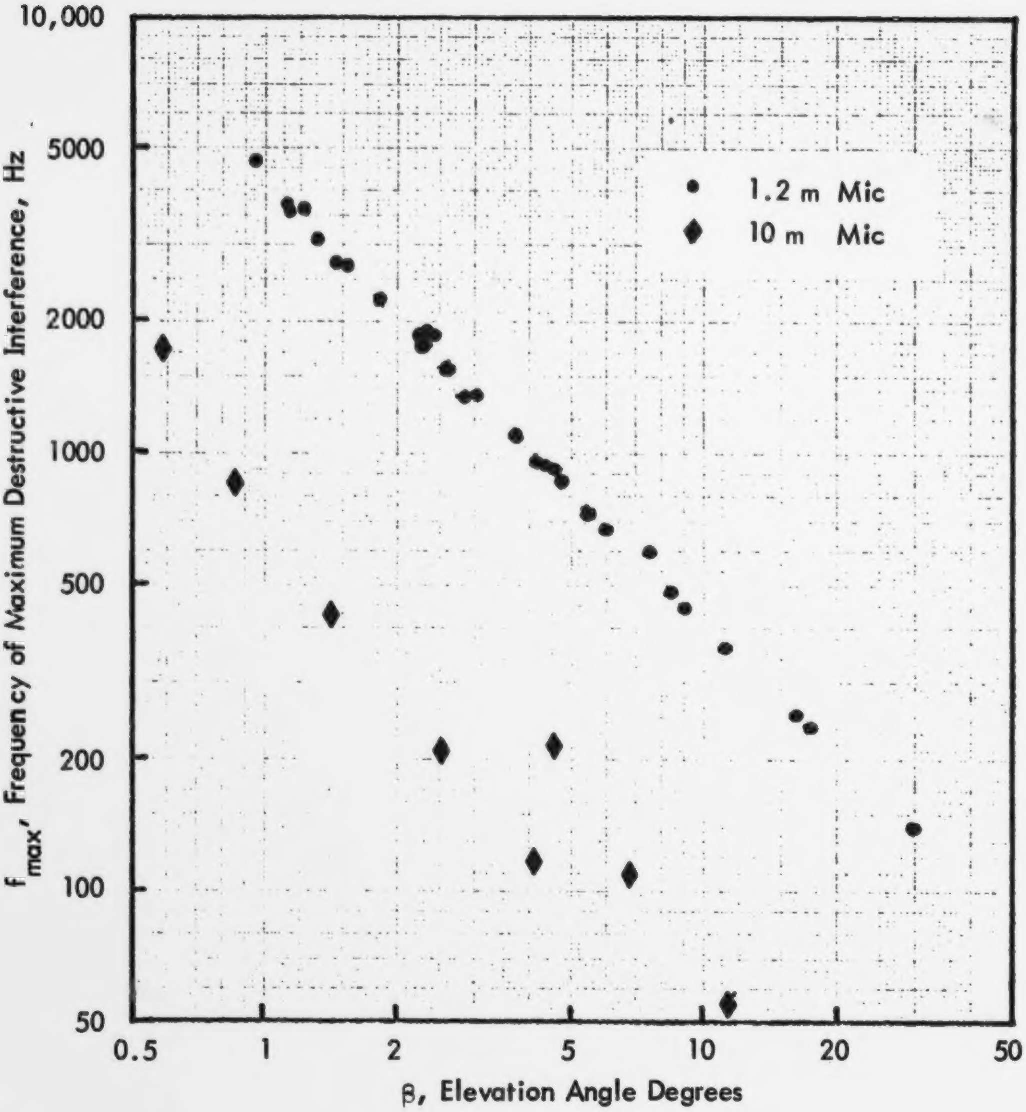


Figure 2. Values of the Reflection Angle β, vs the Theoretical Frequency for Maximum Interference f_{max}, for a Rigid Ground Plane, for the T-38A Tests.

Since $\beta \approx (H_S+H_R)/d$ for small β

then, by eliminating d from the above expressions for β and f_{max},

$$f_{max} \simeq c\,(H_S+H_R)/4\beta\, H_S H_R = (c/\beta)\,\frac{1 + H_R/H_S}{4H_R}$$

Thus, for fixed microphone and source heights, H_R and H_S, the frequency of maximum interference f_{max} is roughly inversely proportional to the grazing angle β and independent of the source-receiver distance d. This is the relationship exhibited in Figure 2. For actual ground surfaces, the frequency of maximum interference will occur at a lower frequency than indicated by this expression. However, this deviation from this simple model will also tend to vary uniquely with the grazing angle β so that matching the range of f_{max} and β, assuming a rigid ground plane, should also effectively match the same parameters over real ground surfaces. It remains to be shown that by appropriate choice of the source-receiver geometry, the parameters f_{max} and β for the T-38A tests were, in fact, duplicated, quite well, by the static tests.

2.2.2 Selecting Horizontal Source-Microphone Separation Distances

In order to establish the horizontal separation distances (d), the T-38A source-microphone separations were first scaled down by 1/2 or 1/4. These distances are listed in Table 2 with their scaled down values, relative to those for the T-38A tests. (For purposes of the static test, the basic distance interval for the microphone separation was changed from 231 m for the T-38 tests to 225 m.) Also shown is a position at 28.1 m (1/8th of 225 m), which was selected as the closest position desired. The position at 675 m (3 x 225) was selected as the most distant, where the received sound level is expected to be marginal. Other distances were selected based on their scaled relationship to the T-38A test separation distances.

Table 2

Scaled Distances Obtained by Multiplying the T-38A Source-Microphone Separations by 1/4 or 1/2

Static Test Distance (m)	Approx. Scale Relation to T-38A Separations			Distances Selected for Static Tests
	Full[†]	1/2	1/4	
28.1[*]				X
56.25			X	X
112.5		X	X	X
168			X	
225	X	X	X	X
281			X	
337		X	X	X
407			X	
450	X	X	X	X
563		X		
675	X	X		X
815		X		
900		X		

[*] Closest desired position.

[†] The actual T-38A distances were 231, 463, 694, 926, 1158, 1389, 1620, and 1852 m.

Based on the preceding concepts, the static test configuration design was finalized after imposing the following practical constraints:

$28 \text{ m} \leq d \quad 675 \text{ m}$ (675 m was the approximate outer bound for adequate signal reception)

$2.5 \text{ m} \leq H_S < 10 \text{ m}$ (10 m was near a practical height limit for a convenient movable source platform)

$H_R = 0, 1.2$ or 10 m (surface to 10 m microphone poles)

Within those constraints, it was possible to cover most of the range of f_{max} vs β from the T-38A tests, shown in Figure 2, with a wide distribution for β and f_{max} for the static test and scaled values of the separation distance, d, with the following array of positions for the source and microphone heights and horizontal separation for the microphones (see Table 3).

Table 3

Source and Microphone Positions for Static Test Program

Nominal Source* Ht., m	Source - Microphone Separation, m						
	28.1	56.2	112.5	225	337.5	450	675
2.5	c	c	c	b	c	a	c
5	c	c	c	b	c	a	c
10	c	c	c	b	c	a	c

a Microphones at 1.2 and 10 meters.

b Microphones at 0, 1.2, and 10 meters.

c Microphones at 1.2 meters only.

* See footnote at bottom of Table 4, p. 15, for true source height.

In developing the measurement position plan summarized in Table 3, a special effort was made to provide a large number of test configurations which corresponded to low values of the grazing angles β. The resulting mix of values of f_{max} vs β for the static test are compared in Figure 3 with the same values shown earlier in Figure 2 for the T-38A test. Clearly, the static test configuration covers most of the range of f_{max} and β as for the T-38A test, but in a somewhat different pattern.

As a final demonstration of the degree of matching of test parameters between the static test and the T-38A flight test, Figure 4 compares the distribution of the separation distance, d, vs the grazing angle, β, for the two tests. The static test covers the same range of d vs β as the flight test for $d < 675$ m and also has substantially more measurements at low values of β in this range of d. This partially compensates for the lack of any data in this static test beyond 675 m where the flight test had many measurements for $\beta < 5^{\circ}$.

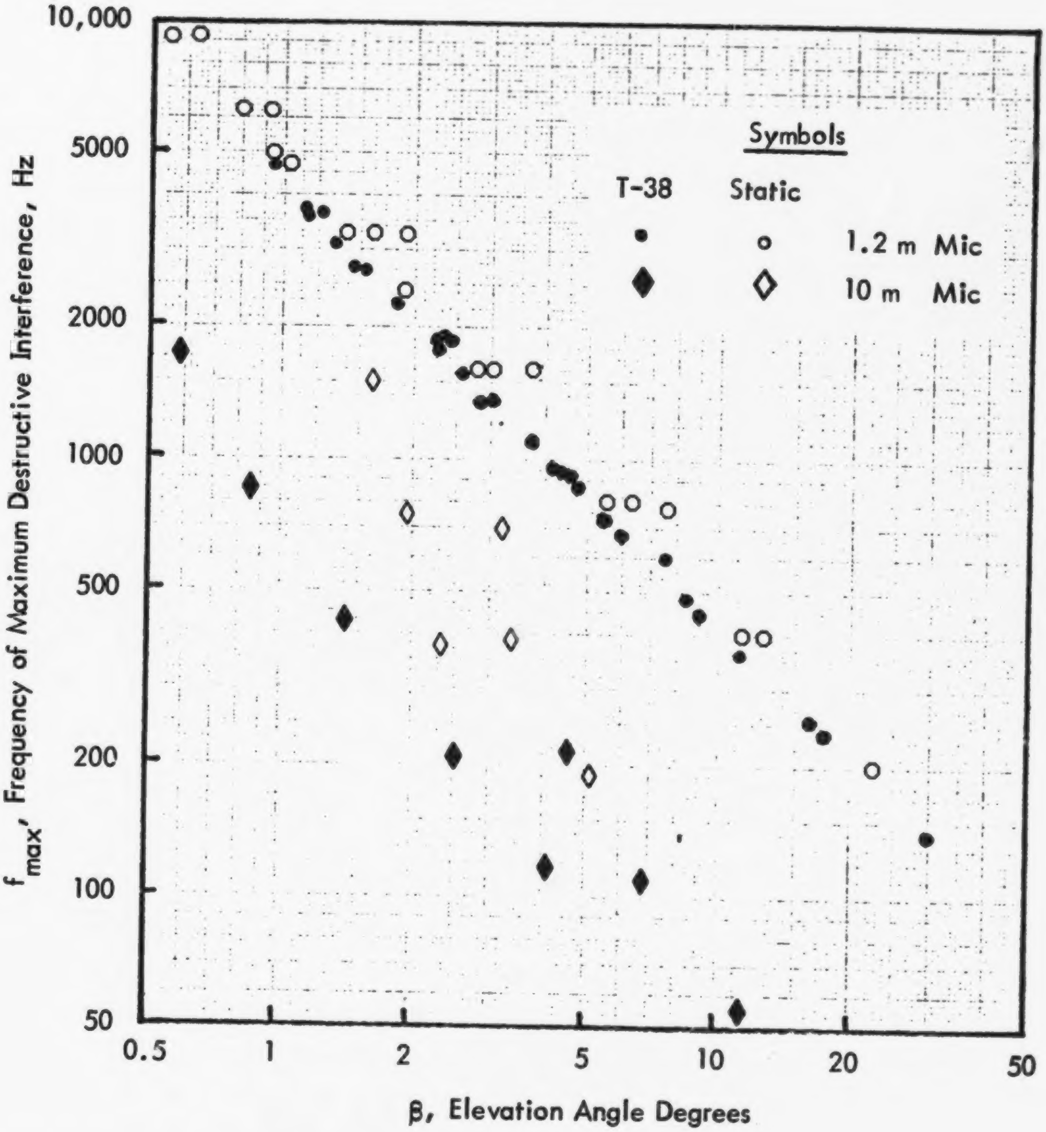


Figure 3. Comparison of the Reflection Angle β, vs the Frequency of Maximum Interference f_{max}, Between the T-38A Tests and the Static Test Geometry.

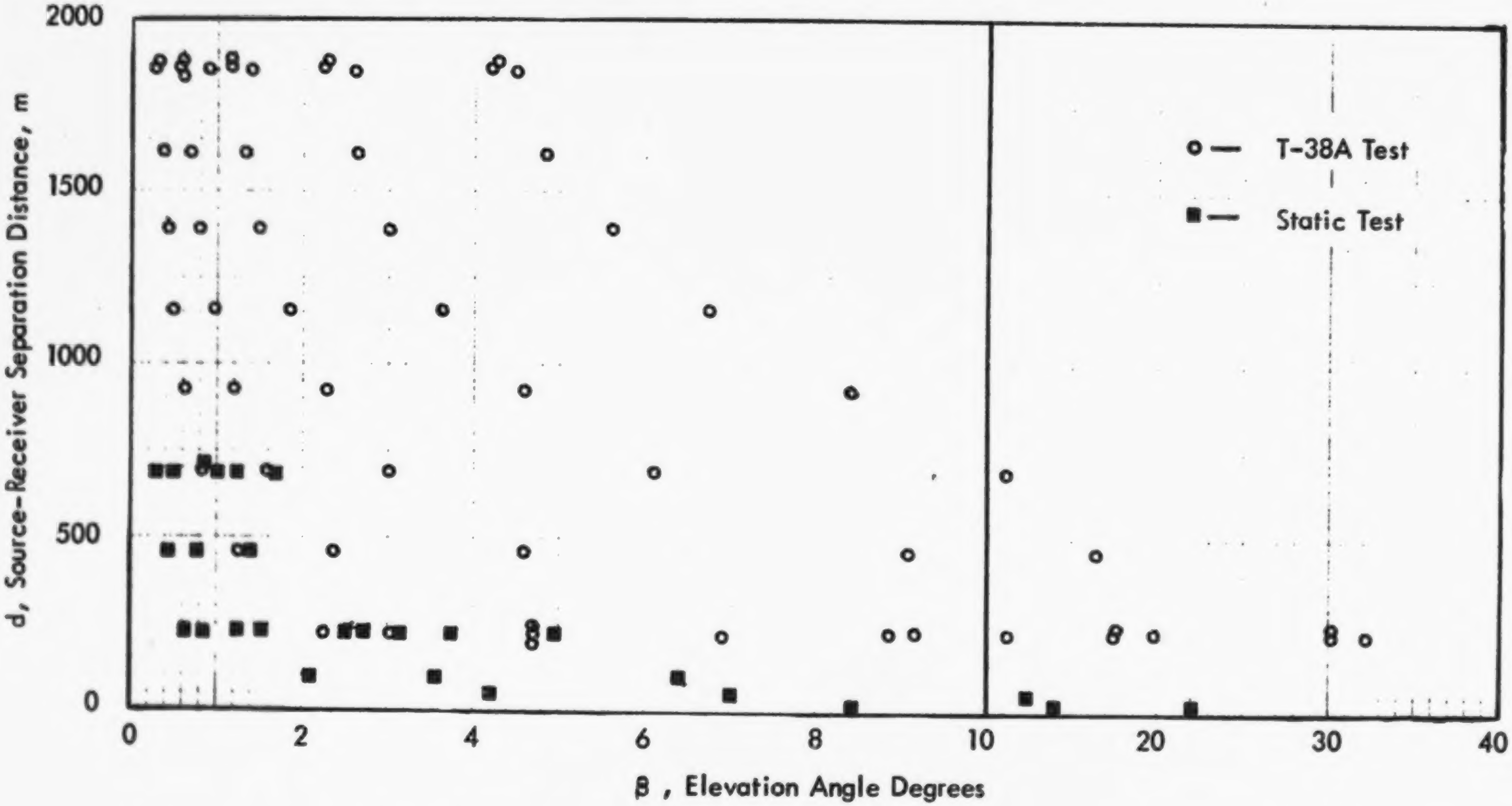


Figure 4. Comparison of Distribution of Source-Receiver Separation Distance d vs Elevation Angle β for the T-38A and this Static Test.

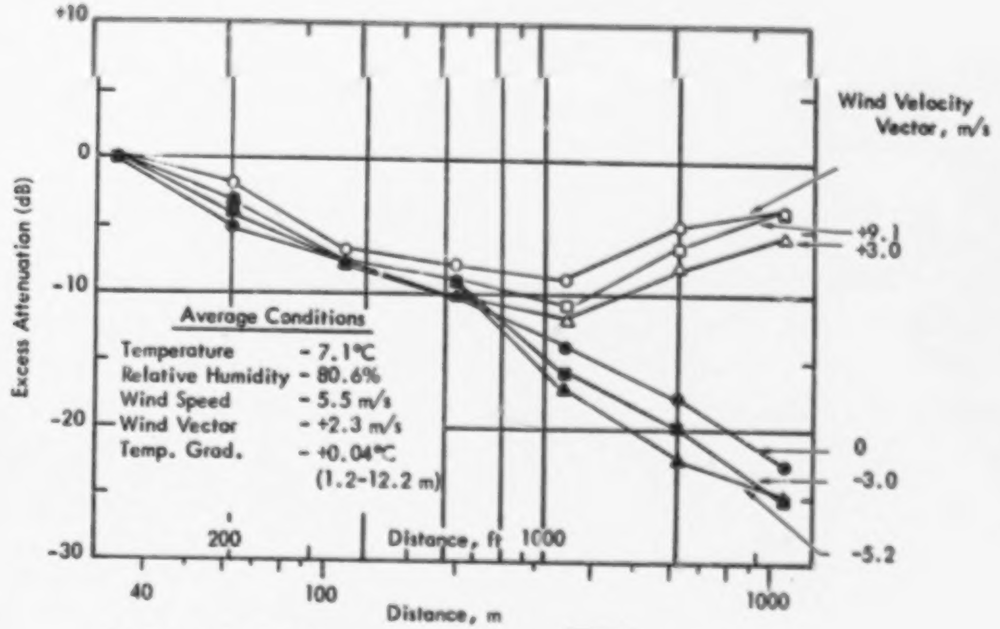
One final note is in order on this topic of matching experimental conditions between the static and T-38A test measurements. Zorumski[4] has shown how the applicability or accuracy bounds of the various theoretical models for EGA (i.e., plane wave theory, Ingard-Rudnick theory, Chien-Soroka theory, and Wenzel (surface wave) theory)[1,4] depend upon the elevation angle between the base of the receiver and the source (essentially the same as the grazing angle β for most practical cases), and the parameter f/σ which defines ground impedance. Again, since these three variables, β, f, σ will have essentially the same values for both the static and flight tests, the conditions under which agreement between theory and static test results can be evaluated should be directly comparable to corresponding conditions for the T-38A tests, all other things being equal.

2.3 Expected Influence of Surface Meteorology on Test Results

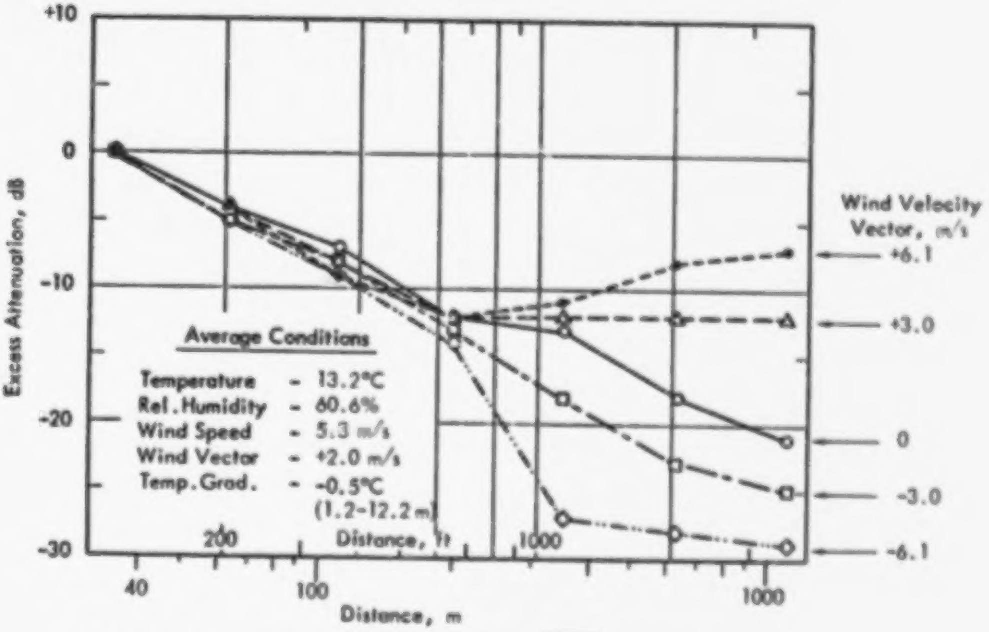
Weather is the one variable which is the most critical source of degradation of outdoor sound propagation test results, and careful planning was required to minimize the problem. Perhaps the most direct and informative evidence of the importance of weather conditions for this experiment is provided by two sets of experimental data; (1) the classic and relatively well-known data on horizontal sound propagation over grassy areas carried out by Parkin and Scholes,[10, 11] and (2) the equally extensive but less well-known results of Tedrick and Polly[12] on sound propagation from an elevated source over forested flat delta land. Both sets of experiments are unique in that they represent a larger number of measurements taken over a wide range of weather conditions so as to allow sorting out deterministic weather effects from other random effects. Figure 5 represents the results of a detailed, independent reevaluation by the authors of this report of the Parkin and Scholes data at a frequency of 400 Hz where they found that excess ground attenuation tended to be a maximum. This provides a clear picture of the relative significance of vector surface winds (in the direction of sound propagation) and vertical temperature gradients (dT/dZ) on the EGA values observed by Parkin and Scholes.

Figure 5(a) is for the case of a neutral or slightly positive temperature gradient while Figure 5(b) is for lapse or negative temperature gradient conditions. The formation of shadow (or focusing) zones, depending on the vector wind velocity, is quite apparent in each case.

Figure 6 presents a typical result from the Tedrick and Polly study which shows how the mean total attenuation, in excess of inverse square losses, varied systematically



(a) Twenty-Six Tests Under Neutral Conditions ($\overline{dT/dZ} \approx +0.004$°C/m).



(b) Twenty-Four Tests Under Lapse Conditions ($\overline{dT/dZ} \approx -0.05$°C/m).

Figure 5. Excess Attenuation at 400 Hz Over 5-15 cm Grassland, Hatfield (data from Parkin and Scholes, Ref. 10).

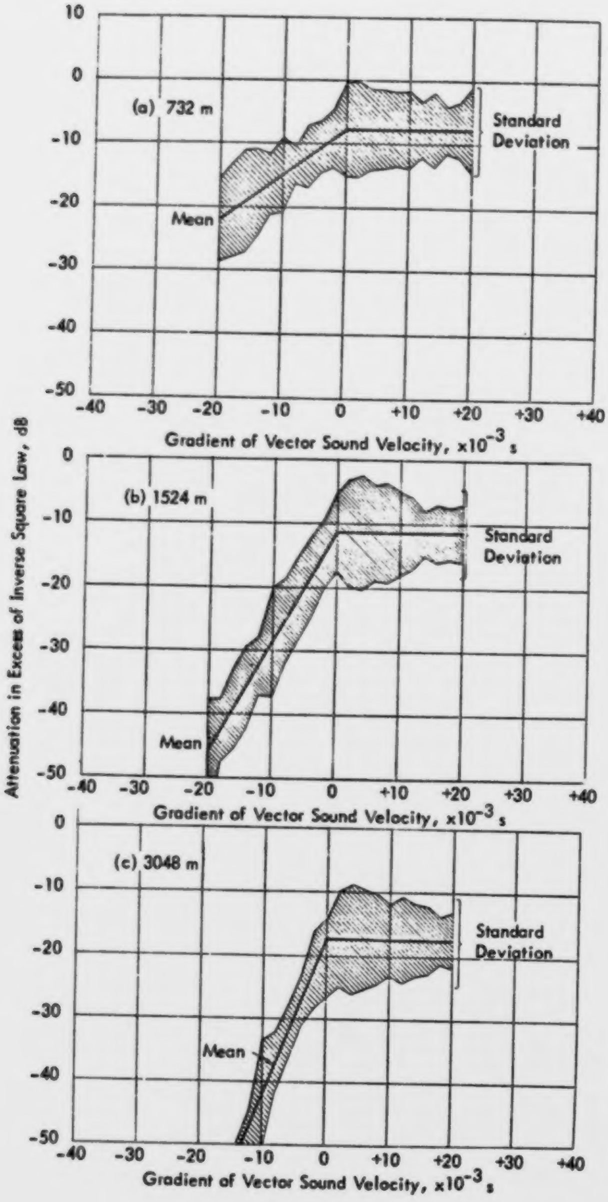


Figure 6. Attenuation in Excess of Inverse Square Law Spreading Loss as a Function of Gradient in Vector Sound Velocity for 160 Hz Source, Mounted on 18.3 m Tower, Propagating Over Flat, Wooded Delta Land at Distances of: (a) 732 m, (b) 1524 m, and (c) 3048 m (Data from Tedrick and Polly, Reference 12).

as a function of the gradient in vector sound velocity. While only a portion of their results are shown in Figure 6, the same trend was observed for all the data (i.e., propagation loss measurements over a 1 year period from a pure tone source at 40, 80, 120, and 160 Hz mounted on an 18.3 m tower and propagating over flat, wooded delta land over a range of 366 to 3048 meters). While this measurement configuration is quite different from that utilized for this study, the sensitivity of the results to the gradient in sound velocity is considered fully applicable.

Thus, the data in Figures 5 and 6 are considered representative of weather effects that were expected in this program for measurements at the lowest elevation angles. Two major points become clear upon examination of the combined trends observed from these studies.

- Sound Velocity Gradient

The best results, presumably in agreement with theory for EGA, will probably be obtained when the sound velocity gradient is neutral (zero or very slightly positive).

- Vector Wind Velocity

As expected, these "ideal" conditions also require that the vector wind - the wind velocity component along the line of sound propagation - be close to zero. In fact, note that for the case plotted in Figure 5(b) for a lapse temperature profile or slightly negative temperature gradient, a slightly negative vector wind, or wind blowing from receiver to the source, was required to achieve apparently "ideal" conditions. "Ideal," in this case, implies that the observed EGA increases at the the log-linear rate of close to 20 dB per decade as expected theoretically (i.e., sound pressure decays as $1/r^2$ instead of $1/r$ due to excess ground attenuation).[1, 9]

Thus, care was taken to obtain the sound propagation measurements under as close to ideal weather conditions as possible. However, only one weather constraint was actually applied in limiting the time any measurements were taken - namely, a maximum limit on wind speed.

This upper limit on wind speed, set at about 3 m/s, was violated in only two out of 41 measurement runs. More significantly, the mean wind speed, over the propagation path layer, over all runs was 1.1 m/s with a standard deviation of 0.7 m/s. About 25 percent of the runs had a mean wind speed of less than 0.5 m/s.

No attempt was made to also control the conduct of the tests according to a limit on sound velocity gradient since the wind speed limit was sufficiently severe to limit the frequency of conducting measurement runs to a practical value from a logistics standpoint. Applying any more constraints for sound velocity gradients would have only further restricted the number of measurements during the test period when the test area, test facilities, and test personnel were fully committed to obtain the data. This was not considered cost-effective. Thus, for this program, the measured data were screened in the final analysis process, according to the actual weather conditions obtained, to achieve, in effect, the additional desi[illegible] constraints on the gradient in vector sound velocity. In fact, for the 41 measurement runs, all but the last two had a positive gradient in vector sound velocity (from source to receiver) over the propagation path layer which averaged, over all runs, $+0.50 \pm 0.22\ s^{-1}$.

3.0 MEASUREMENT SYSTEM AND PROCEDURES

3.1 Test Site and Microphone Positions

The acoustic instrumentation required for the propagation experiment, conducted from November 17-19, 1979, consisted of a sound source mounted on an elevating platform and two arrays of microphones extending over a range of 675 meters at Wallops Flight Center, Wallops, Virginia. The arrays consisted of measurement positions over the grass infield and on the asphalt concrete (AC) surface of runway 04-22 at this center. As explained in a more detailed site description in Reference 3, the first 460 m of this 50 m wide runway was a grooved bituminous concrete surface and the next 214 m, extending to the approximate end of the microphone array, was paved with Gripslop asphalt. The 115 m wide grass surface, underlaid by a sand and clay soil, was interrupted between the farthest two microphones by a paved taxiway. Figure 7 is a plot plan of the measurement site showing the contour elevation lines and location of the instrumentation. Note that the centerline of each of the two measurement lines has a variation in elevation along its length of less than 0.61 m except for microphone 10 along the grassy surface which is about 0.91 m below the corresponding elevation at the source position. Figure 8 illustrates the positions where acoustic measurements were made relative to the two positions of the sound source. The small table accompanying the figure identifies the microphones, 10 in each array, at each receiving location, according to the plan already defined in Table 3 of the preceding section.

At the 225 m position a vertical array was used with three microphones; at ground level, 1.2 meters above ground and 10 meters high. At the 450 m position, two microphones, one at 1.2 meters and one at 10 meters, were used. These vertical microphone arrays were spaced 1 m laterally to prevent interference. Table 4 lists the microphones at each measurement point, the horizontal separation distance, d, to the source position and the microphone height H_R above ground and, for each of three source heights (H_S) used, indicates the grazing angle β of the reflected ray between the sound source and microphone position (see Figure 1).

The reference microphone (No. 21) was mounted on a boom attached to the platform supporting the sound source, as illustrated in Figure 9, such that it was always at the same position relative to the source: a distance of 5 m. This distance was selected to assure that the reference microphone would be in the far field of the sound source at all frequencies of interest. (This distance exceeded 1.3 wavelengths at the lowest frequency

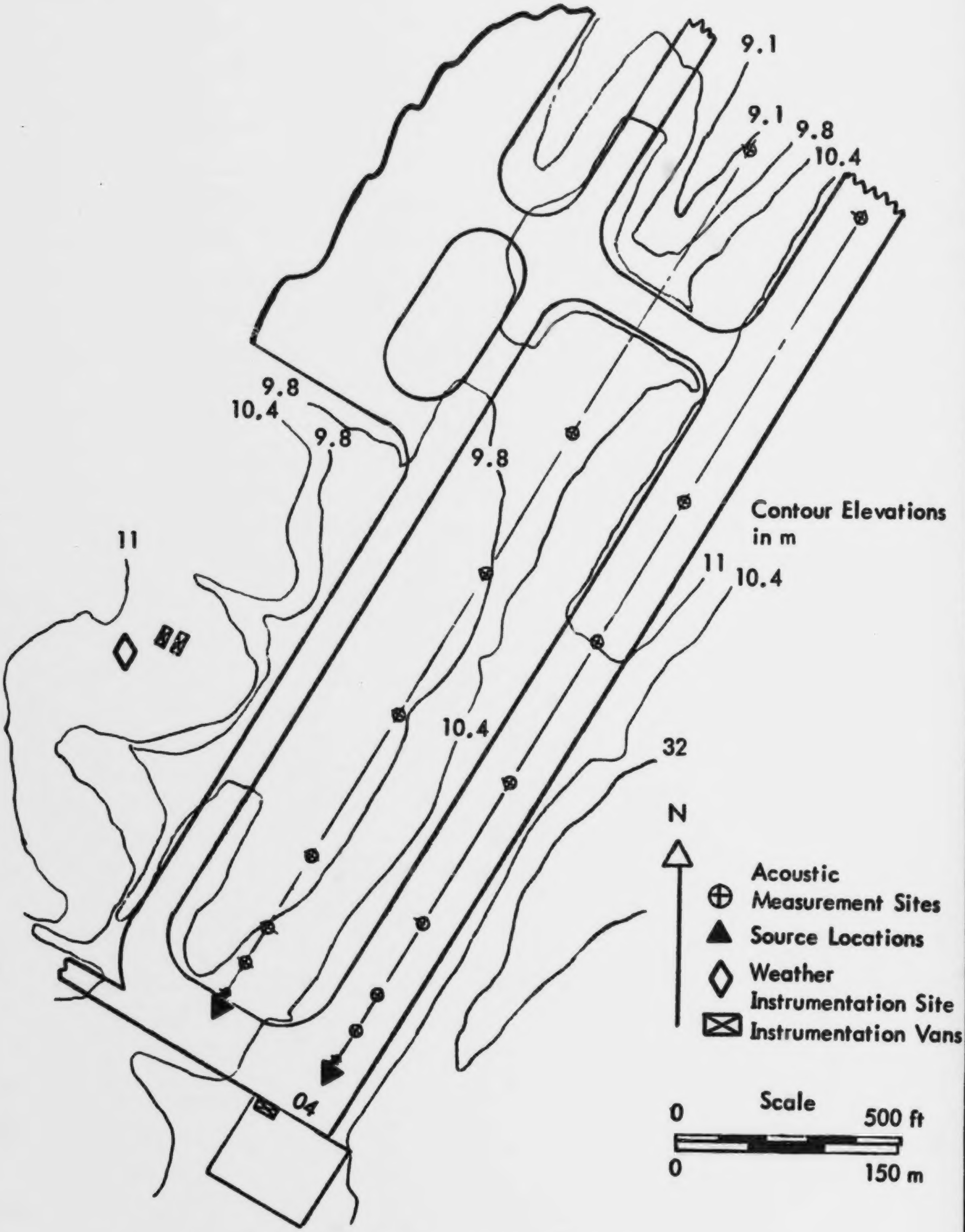
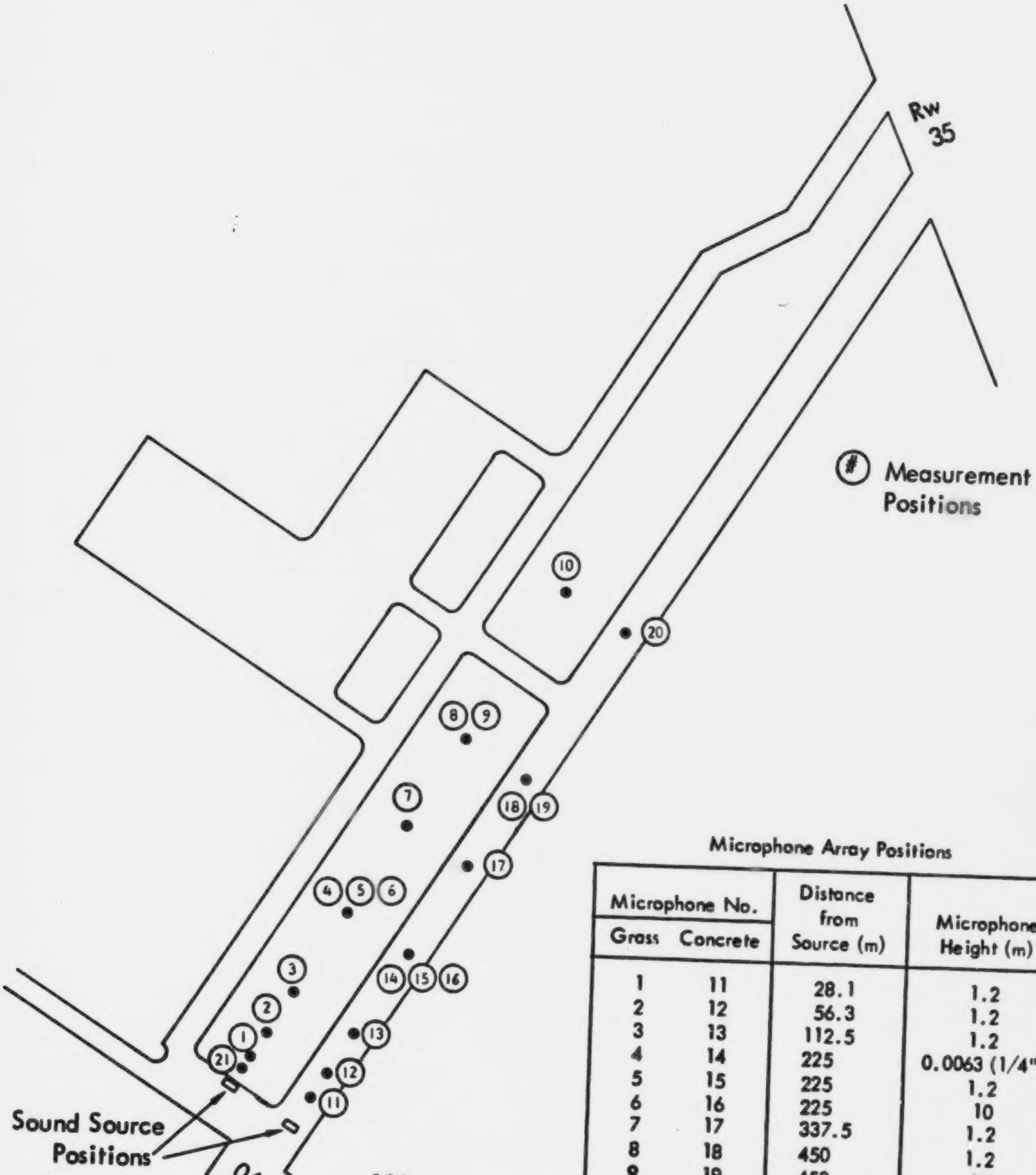

9.1
9.1
9.8
10.4
9.8
10.4
9.8
9.8
Contour Elevations in m
11
11
10.4
10.4
32
N
⊕ Acoustic Measurement Sites
▲ Source Locations
◇ Weather Instrumentation Site
☒ Instrumentation Vans
04
Scale
0
500 ft
0
150 m

Figure 7. Plot Plan and Contour Lines of EGA Measurement Site.


Rw 35
# Measurement Positions
10
20
8
9
18
19
7
17
4
5
6
3
14
15
16
2
13
1
21
12
11
Sound Source Positions
04
100 m
Scale

Microphone Array Positions

Microphone No.		Distance from Source (m)	Microphone Height (m)
Grass	Concrete		
1	11	28.1	1.2
2	12	56.3	1.2
3	13	112.5	1.2
4	14	225	0.0063 (1/4")
5	15	225	1.2
6	16	225	10
7	17	337.5	1.2
8	18	450	1.2
9	19	450	10
10	20	675	1.2

Microphone 21 is the Reference Microphone.

Figure 8. Acoustic Measurement Positions Along and Near Runway 04 at Wallops Flight Center.

Table 4

Microphone Positions Relative to the Sound Source and Resultant Grazing Angles of Reflected Ray Between Each Microphone and the Source

Microphone Number	d, Horizontal Separation Distance from Source Position,(m)	H_R Microphone Height, (m)	β, Grazing Angle of Reflected Ray Between Microphone and Source (Deg) for Source Heights H_S,(m) *		
			2.5 m	5 m	10 m
1 and 11	28.1	1.2	7.50	12.44	21.73
2 and 12	56.3	1.2	3.76	6.28	11.25
3 and 13	112.5	1.2	1.88	3.15	5.69
4 and 14	225	0	0.64	1.27	2.54
5 and 15	225	1.2	0.94	1.58	2.85
6 and 16	225	10	3.18	3.81	5.08
7 and 17	337.5	1.2	0.63	1.05	1.90
8 and 18	450	1.2	0.47	0.79	1.43
9 and 19	450	10	1.59	1.91	2.54
10 and 20	675	1.2	0.31	0.53	0.95
21	5	Same as Source	45.0	63.43	75.96

*$\beta = \tan^{-1} (H_S + H_R)/d$

The nominal source heights listed, used to define the grazing angle β , actually correspond to the height of the mounting platform. The approximate acoustic center of the sources would be about 0.42 m higher for frequencies from 50 to 500 Hz and 1 m higher for frequencies above 500 Hz.

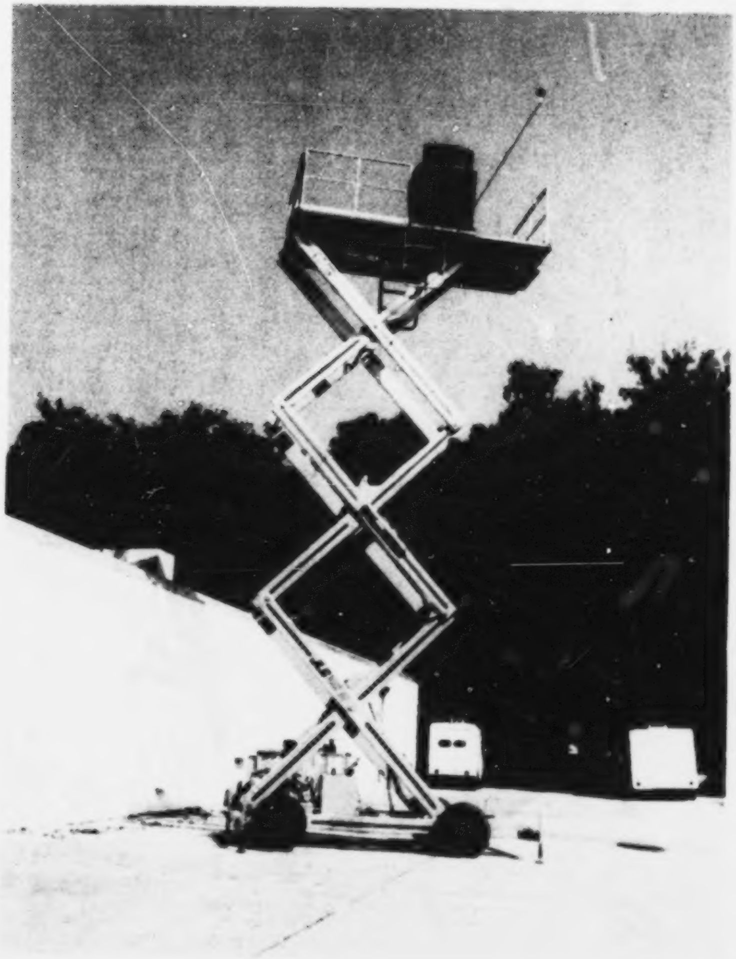


Figure 9. Sound Source and Reference Microphone Elevated to the 10 m Position (obstacles adjacent to source platform in this photo were not present in the field test).

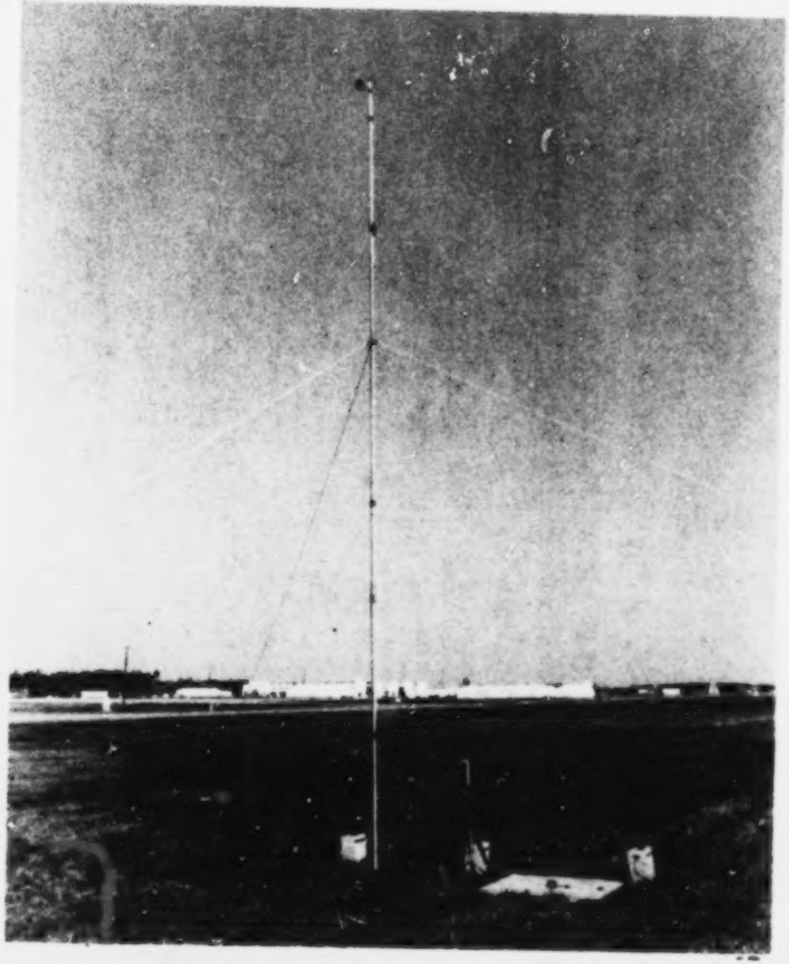


Figure 10. Microphones Number 4, 5 and 6 Over the Grass Surface 225 m from the Source.

of 50 Hz.) With the reference microphone at this location, even minor variations in the source output characteristics were accounted for. The reference microphone accurately measures the source level, with negligible ground reflection effects, when the source is at a 10 m height; however, when it is at a height of 2.5 or 5 m, reflections from the ground will significantly disturb the measured level. Therefore, the reference level measured at 5 m from the source when the latter was at a 10 m elevation was used as a source reference level for defining excess ground attenuation for all runs. Care was taken to assure that speaker drive levels did not change when the source was at the other two heights. Evidence of the stability of the resulting source levels is shown later.

All microphones were protected with a windscreen to minimize noise produced by wind turbulence near the microphone. The windscreen, constructed of polyurethane foam, was 9 cm in diameter and completely eliminated any significant wind noise from the data for the low wind speed conditions that existed during the measurements. The ground level microphone was placed directly on a 1.2 m square, 1.9 cm thick ground-board with the microphone diaphragm in a vertical plane containing the source-receiver path and the diaphragm center at a height of 0.635 cm above this ground-board. This microphone was also protected with a foam windscreen which was cut to provide the 1.27 cm spacing. Tests performed by NASA LRC have confirmed that this ground level mounting configuration produces an accurate estimate of the acoustic levels existing on this ground-board for frequencies below 4 kHz. Figure 10, on page 25, shows this installation of all three microphones at the 225 m position over grass.

3.2 Acoustic Measurement System and Test Procedures

3.2.1 Sound Source and Drive System

The sound source used for the EGA propagation experiments consisted of components, manufactured by Altec Corporation, made up of a model 817 low frequency enclosure with two model 515-8LF loudspeakers, and a high frequency system consisting of a model 290G driver mounted on a model 329 horn. Dimensions of the system are portrayed in Figure 11. The complete system weighed approximately 118 kg. All characteristics, frequency response, directivity, impedance, and distortion were documented in Reference 13. The maximum acoustic output of the system for a sinusoidal input signal is displayed in Figure 12. From these data, extrapolations were made to estimate the sound level expected at the position of each microphone. These estimated levels are shown in Figure 13 at distances of 5, 225, 450 and 675 m from the source, not

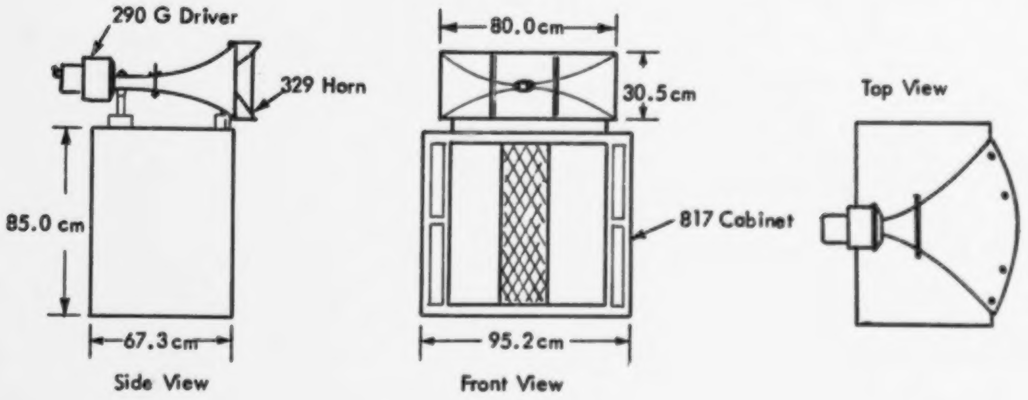

290 G Driver
329 Horn
85.0 cm
67.3 cm
Side View
80.0 cm
30.5 cm
95.2 cm
817 Cabinet
Front View
Top View

Figure 11. Dimensions of the Altec Sound System Used for the Source.

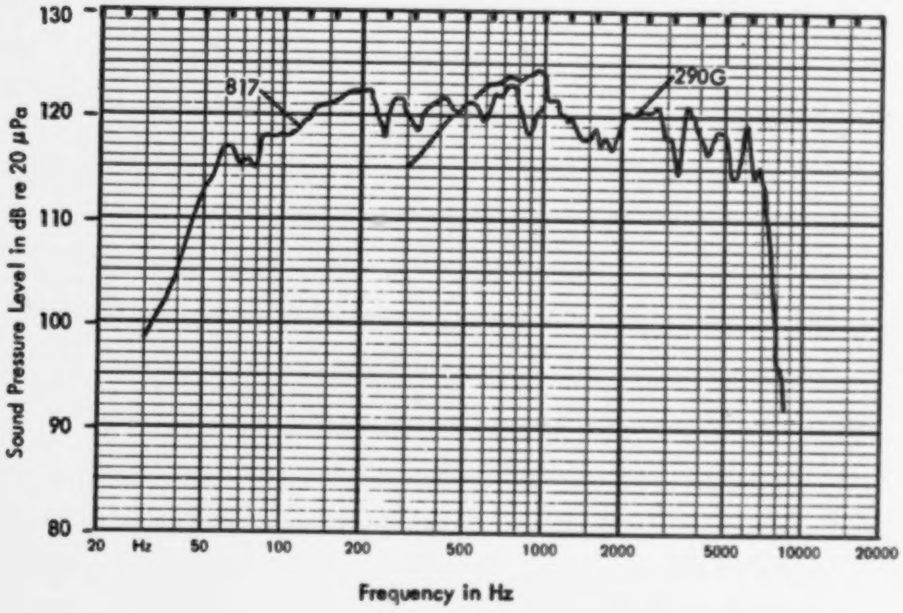


Figure 12. Maximum Sound Pressure Level of the Altec Model 817 Low Frequency Loudspeaker and the Model 290G High Frequency Driver on a Model 329 Horn at a Distance of 2 meters (Sinusoidal Input Signal).

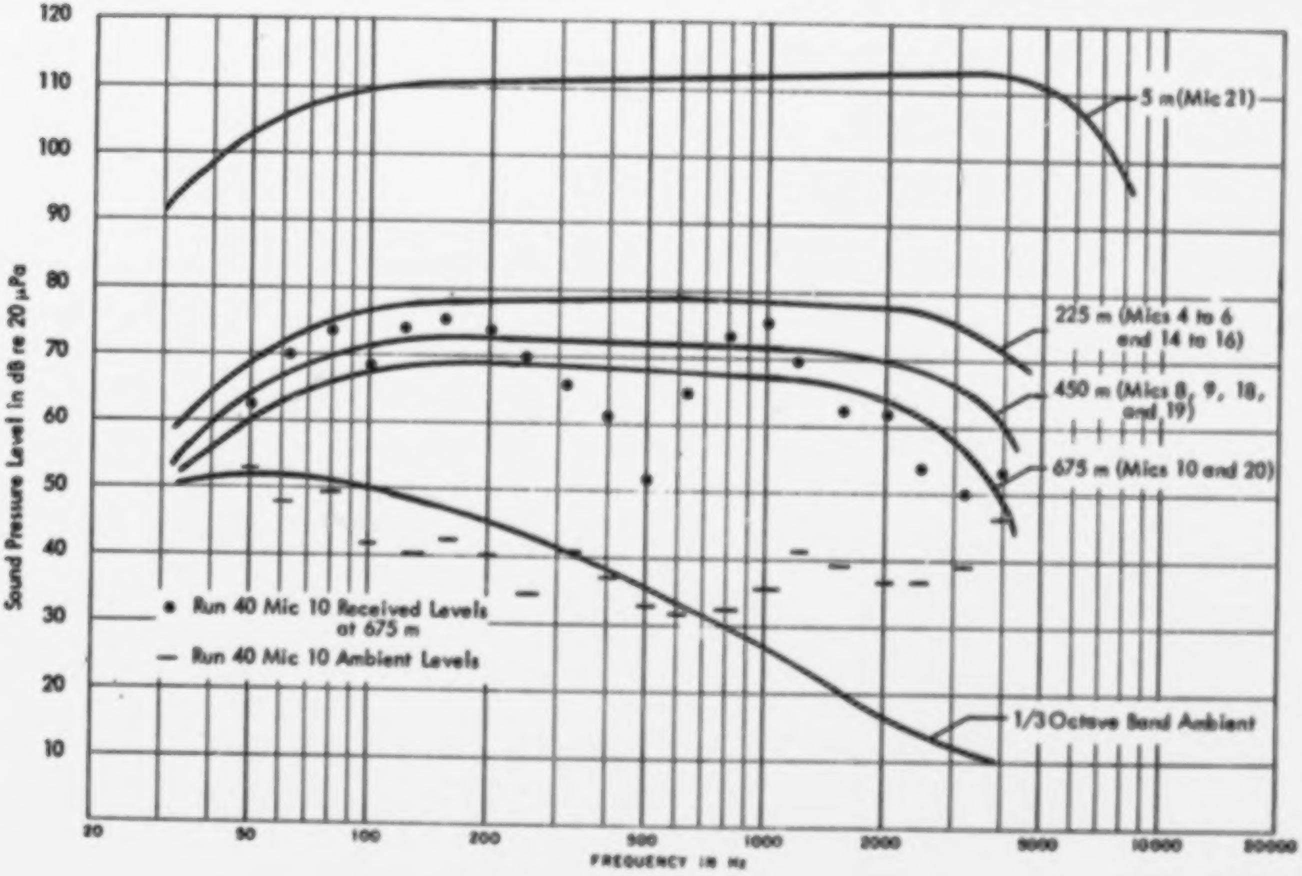


Figure 13. One-Third Octave Band Sound Levels Expected at Wallops Flight Center Measurement Locations at 675 m for Temperature = 10°C (50°F) and RH = 70% (No EGA Added).

including the excess ground attenuation, along with the levels actually achieved at the further distance (675 m) for a typical run. Also shown is the approximate one-third octave band ambient level expected and the values actually measured for the same run. In this case, the measured level at 4000 Hz, and possibly at 3150 Hz, were influenced by the ambient background noise. Thus, at all but the highest frequencies, an adequate signal-to-noise ratio was expected and obtained at the farthest microphone for this run. However, as explained later, signal to ambient background noise was carefully monitored throughout the program and, in some cases, appropriate corrections were made when necessary as defined in Section 3.4.1.1.

Directivity characteristics of the acoustic source are illustrated in Figure 14. Consideration was given to the possibility of rotating the high frequency horn 90° about a horizontal axis to minimize the effects due to its off-axis directivity. As indicated by the data in Figure 14, the horn had a broader beamwidth in the horizontal plane at high frequencies and thus it could have been advantageous to reposition the horn by 90° to obtain the most uniform coverage in the vertical plane. However, the arrangement of the microphone measurement array is such that the total spread in propagation angle required is 24 degrees (2° looking up along the direct path to the microphone at a distance of 225 m at a 10 m elevation for the source at 2.5 m elevation, and 22° looking down along the reflected ray path to the 1.2 m microphone at a distance of 28.1 m for the source at 10 m elevation). Therefore, if the sound source is pointed downward to bisect this angular spread, a uniform directivity over an angle of only 12 degrees (on either side of the source axis) is required. Thus, rather than rotate the horn about a horizontal axis by 90°, the rear side of the entire loudspeaker cabinet was elevated 13 cm to tilt the source axis downward by 10 degrees. In this way, the source directivity was maintained constant, within about ±1 dB, over the 24° angle spread required to cover the microphone array.

A block diagram of the sound source drive system is illustrated in Figure 15. The capability of transmitting both one-third octave band levels and sine wave signals is shown. However, for this program, only 20 sec bursts of one-third octave bands of pink noise, timed by the tone burst generator, were transmitted. This gated signal was first clipped using a back-to-back diode clipper to minimize peak signal excursions and was then passed through a 500 Hz low-pass filter to the low frequency channel of the power amplifier or directly to the power amplifier for the high frequency channel. This signal was also recorded on the same tape recorder as the microphone signals. This source signal

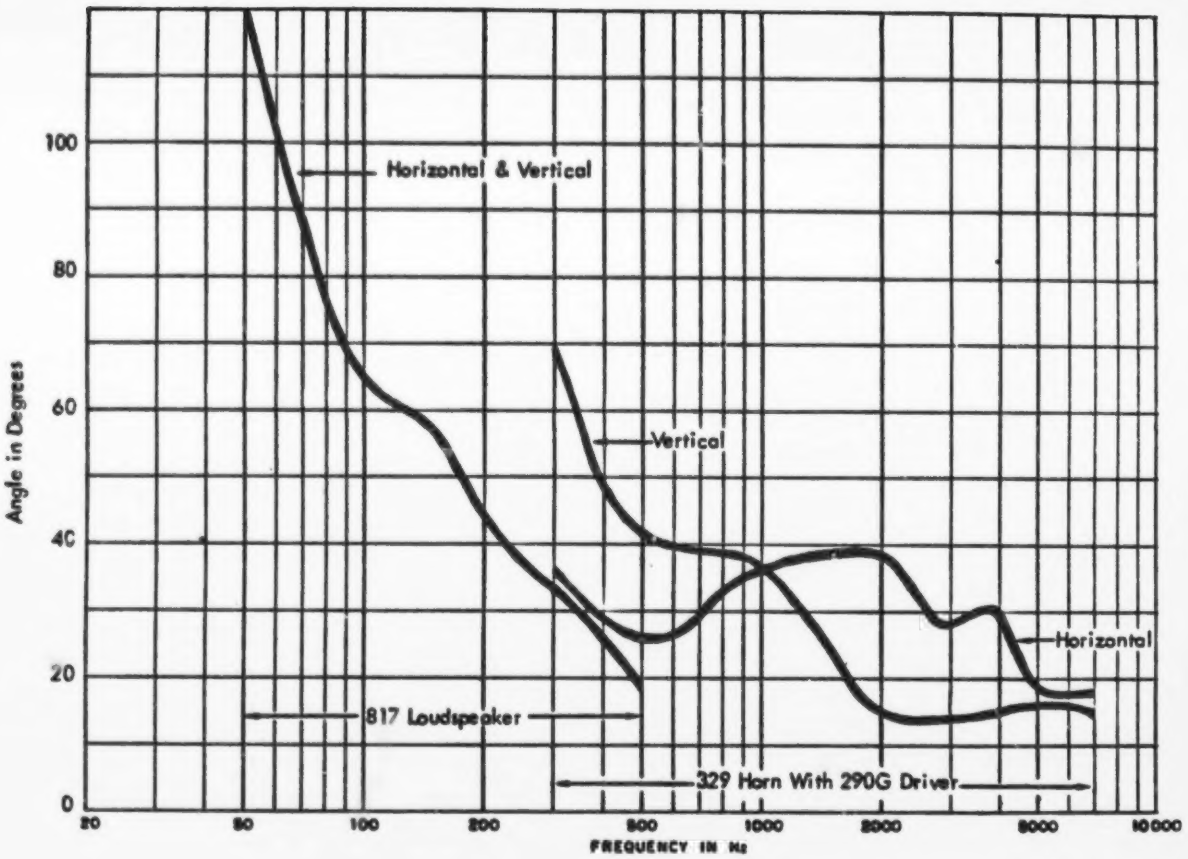


Figure 14. Horizontal and Vertical Angle at Which the Response of the Acoustic Source is Down 3 dB.

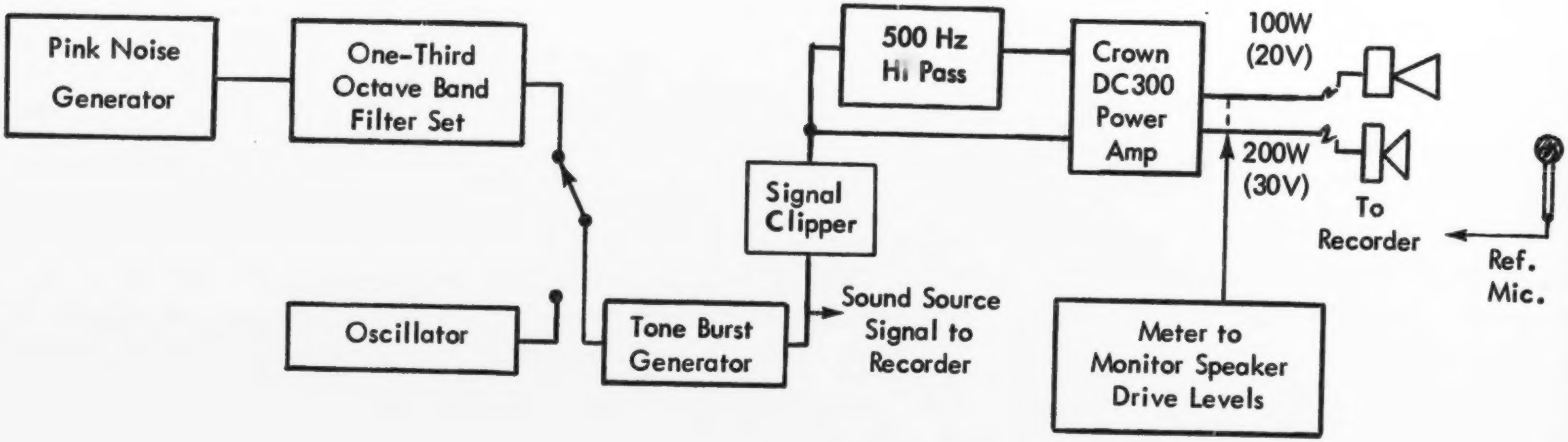

Pink Noise Generator
One-Third Octave Band Filter Set
Oscillator
Tone Burst Generator
Signal Clipper
Sound Source Signal to Recorder
500 Hz Hi Pass
Crown DC300 Power Amp
100W (20V)
200W (30V)
To Recorder
Ref. Mic.
Meter to Monitor Speaker Drive Levels

Figure 15. Sound Source Drive System (only burst of pink noise were used for the EGA experiment).

equipment was mounted in an instrumentation van located near the source platform, as indicated in Figure 7.

The movable platform on which the source was mounted, illustrated earlier in Figure 9, was a JLG Model 355 portable work platform which was easily moved between the two source locations and elevated to the desired height. Once in place, the unit was raised off its rubber tires by jack-screw pads; its rigidity and the low winds during each run made it unnecessary to use guy wires to maintain a fixed source position. The face of the low-frequency speaker cabinet, which was located at the edge of the platform facing the microphone array, was assumed to be the horizontal position of the source in the direction towards the microphones. The nominal vertical position of the source above the ground, used throughout this report, was measured from the top of the loudspeaker mounting platform to the concrete surface on which the platform was located. The actual acoustic center of the source would be about 0.42 m higher for all frequencies from 50 to 500 Hz and 1 m higher for all frequencies above 500 Hz.

3.2.2 Acoustic Data Measurement System

A block diagram of the acoustic data measurement system, consisting of the array of 21 microphones deployed at the positions indicated in Figure 7, is illustrated in Figure 16. Also shown in this figure are some of the supporting instrumentation used for system calibration or for on-site analysis of data. The complete data acquisition and calibration systems for 11 microphones and a 14-channel FM tape recorder were located in each of two instrumentation vans - one for each array of 10 receiver microphones plus a common reference microphone. As indicated in Figure 7, the two vans were located about 160 m laterally from the nearest line of microphones over grass. Assignment of source/auxiliary signals and data channels to these two tape recorders was made as indicated in Table 5. The three signals assigned to Channels 12 to 14 were duplicated on both recorders to allow for direct access to signal identification and timing data during data reduction and analysis. In addition, weather data from a 10 m tower, as described in the next section, were stored, in digital format, on the tape recorder committed to the measurements over the grass surface.

3.2.3 Test Procedures for Acoustic Measurements

3.2.3.1 System Calibrations

At the beginning of each test session, the 21 microphone systems were deployed on the airfield and each microphone channel was calibrated. Both an electrical

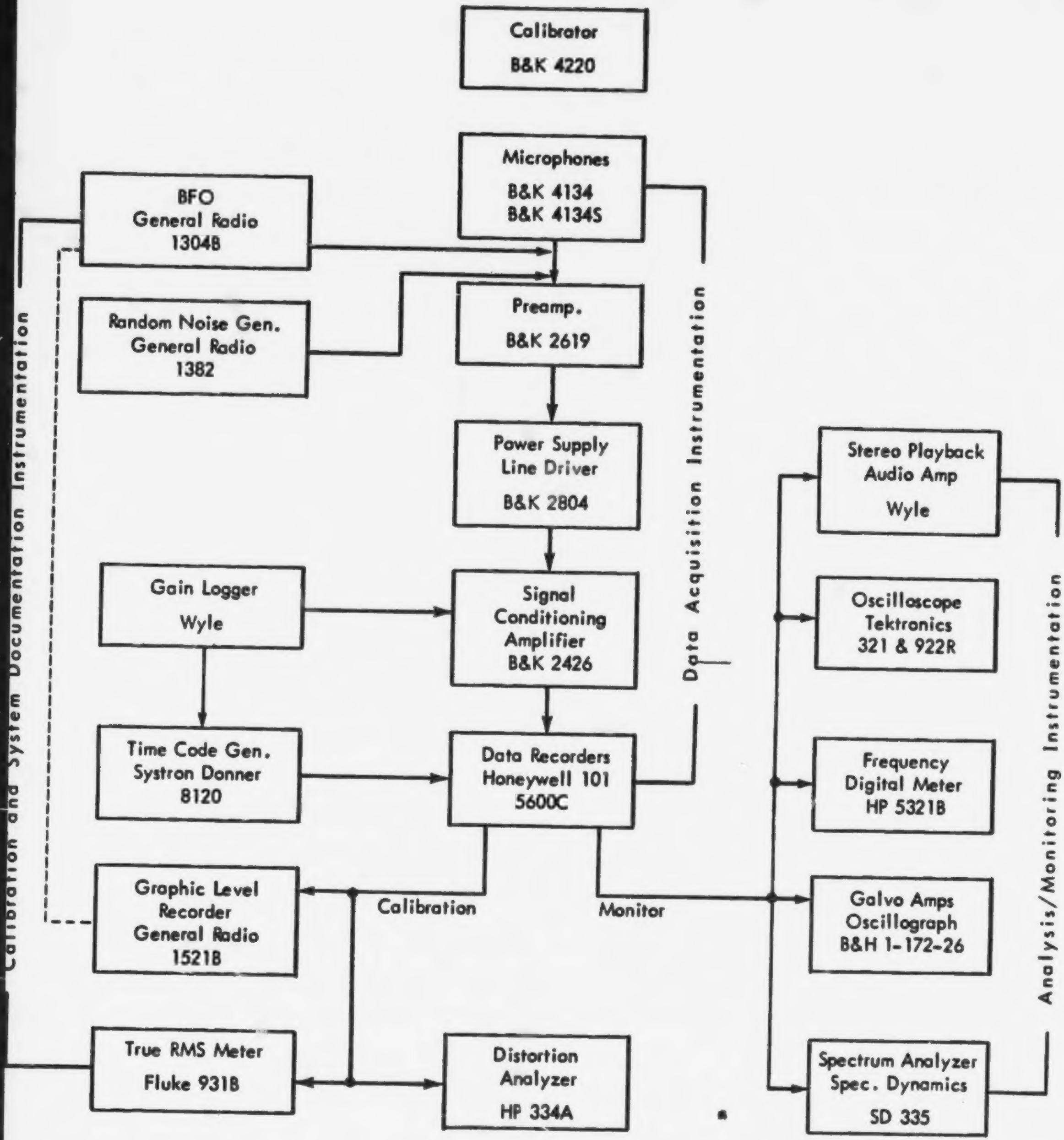

Calibrator
B&K 4220
Microphones
B&K 4134
B&K 4134S
BFO
General Radio
1304B
Random Noise Gen.
General Radio
1382
Preamp.
B&K 2619
Power Supply
Line Driver
B&K 2804
Gain Logger
Wyle
Signal
Conditioning
Amplifier
B&K 2426
Time Code Gen.
Systron Donner
8120
Data Recorders
Honeywell 101
5600C
Graphic Level
Recorder
General Radio
1521B
True RMS Meter
Fluke 931B
Distortion
Analyzer
HP 334A
Calibration
Monitor
Stereo Playback
Audio Amp
Wyle
Oscilloscope
Tektronics
321 & 922R
Frequency
Digital Meter
HP 5321B
Galvo Amps
Oscillograph
B&H 1-172-26
Spectrum Analyzer
Spec. Dynamics
SD 335
Calibration and System Documentation Instrumentation
Data Acquisition Instrumentation
Analysis/Monitoring Instrumentation

Figure 16. Acoustic Data Measurement System Block Diagram.

Table 5

Assignment of Acoustic Data and Auxiliary Signals to Tape Recorder Tracks

Recorder Track	Data or Signal Assigned to: (Grass Surface) Recorder #1	Data or Signal Assigned to: (Asphalt Surface) Recorder #2
1	Mic. 1	Mic. 11
2	Mic. 2	Mic. 12
3	Mic. 3	Mic. 13
4	Mic. 4	Mic. 14
5	Mic. 5	Mic. 15
6	Mic. 6	Mic. 16
7	Mic. 7	Mic. 17
8	Mic. 8	Mic. 18
9	Mic. 9	Mic. 19
10	Mic. 10	Mic. 20
11	Mic. 21	Mic. 21
12	Source Signal	Source Signal
13	Time Code*	Time Code†
14	Voice Annotation	Voice Annotation

*Weather data observed on a 10 m tower was also encoded onto this channel.

†The time code signal recorded on this channel was not retrievable for analysis. However, approximate run times could be estimated from manual run logs.

calibration signal, using a pink noise generator, and an acoustic calibration signal, using a pistonphone, were recorded on tape. An acoustic calibration was also performed at the end of each test session and the resultant signal was again recorded on the data tape. This calibration procedure was supplemented with additional calibrations conducted whenever there were long time intervals between tests, there were marked weather changes, or there were any indications of changes in microphone system performance.

3.2.3.2 System Gain Settings

In order to obtain the maximum signal-to-noise ratio at each microphone location, the gain of each channel was adjusted such that the maximum expected acoustic signal was approximately 10 dB below the maximum record level. This 10 dB margin was maintained to allow for signal fluctuations without distorting the recorded level. For maximum security of the raw recorded data, system gain settings were automatically recorded, by digital attenuator encoder signals, onto the time code channel (No. 13) of each tape recorder. These gain settings were also logged, manually, for convenient use in subsequent data analysis. During each run, visual monitoring of signal levels and signal quality was also maintained and permanent records made, on oscillographic recorders, of the instantaneous signal being recorded on tape.

3.2.3.3 Ambient Background Levels

At intervals throughout each test period, ambient background noise levels were monitored and recorded on tape. For any one microphone, this ambient noise consisted of either acoustical or electrical background noise, or a mixture, depending on the gain setting.[14] Electrical background noise on each microphone channel was higher than desired during the first eight data runs due to grounding problems on the microphone cables. Data from these runs were therefore discarded. This problem was resolved however for all subsequent runs so that very few data points were lost due to excessive ambient background noise levels in any of the remaining 41 tests conducted.

3.2.3.4 Run Sequence

The EGA experiments consisted of a series of runs performed using either the array of microphones over grass or the array over asphalt concrete (AC). Each run consisted of the sequential transmission of 20 bands of pink noise passed, one at a time, through one-third octave filters covering the frequency range of 50 Hz to 4 kHz. Each run was conducted with the source at one of three elevations, 2.5, 5, and 10 meters above the ground and facing one of the two microphone arrays. A measurement session consisted of up to six such runs, three for each source height over each of the two surfaces.

The sequence of these measurement sessions and principal identifying characteristics in terms of run number, microphone channels, ambient data sample utilized, ground surface, source height, date and run time are listed in Table 6. The fourth column identifies the ambient background noise data samples by the letters a through g and indicates when each such sample was first recorded, and for which subsequent runs it was also employed as the measure of ambient background noise for data analysis purposes.

Each band of noise was transmitted for 20 seconds. This signal duration was a practical compromise between the desire for a long measurement period to achieve high accuracy in the mean transmission loss and the need to maintain short signal durations to achieve reasonable run times. In fact, for many of the runs for which atmospheric turbulence was low or atmospheric conditions were relatively stable, minimal changes in level occurred during this 20 second period. In this case, the 20 sec test duration was more than sufficient to achieve a very accurate measure of average excess attenuation for mean weather conditions existing at the time of the run.

The FM tape recorders, with wideband Group I response, were run at a tape speed of 38.1 cm/s resulting in flat response from dc to 10 kHz. This allowed over 1.5 hours of data to be recorded on each reel of tape.

3.2.3.5 Ground Impedance Measurements

During the course of the EGA measurements, the acoustic impedance of the grassy surface was measured in situ employing the technique developed by Piercy and Embleton.[6] The technique consists, essentially, of conducting a small-scale EGA experiment, using the type of geometry illustrated in Figure 17(a). Then, as illustrated by typical results from Piercy and Embleton in Figure 17(b), the observed EGA results are matched to values predicted by a "best fit" value of the flow resistance parameter, σ. As stated earlier, the ratio of frequency (f) to (σ) has been shown to uniquely define the acoustic impedance of a wide variety of ground surfaces.[5, 6, 7] The source consisted of a high frequency compression-type horn driver unit connected directly to a 38 cm long aluminum tube which had an inside diameter of 3.18 cm at the driver end and tapered down to 1.28 cm at the open "point source" end. This source was driven by a sinusoidal signal using compression feedback control so as to maintain a constant output level at the

Table 6

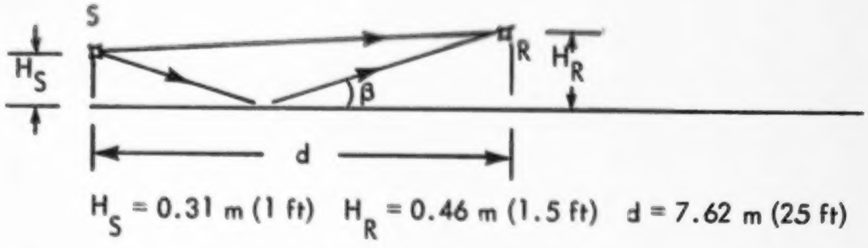
Summary of Run Conditions During Tests at Wallops Flight Center

Session	Run #	Microphone Channels	Ambient Data Used*	Surface	Source Ht. (m)***	Date	Time of Run**
A	9	1-10, 21	a recorded	Grass	10.0	11-17-79	0557
	10	"	a	"	5.0	"	0621
	11	"	a	"	2.5	"	0635
	12	11-20, 21	b recorded	AC	2.5	"	(0655)
B	13	1-10, 21	c recorded	Grass	10.0	11-17-79	1650
	14	"	c	"	5.0	"	1704
	15	"	c	"	2.5	"	1719
	16	11-20, 21	d	AC	2.5	"	(1740)
	17	"	d	"	5.0	"	(1755)
	18	"	d	"	10.0	"	(1810)
C	19	1-10, 21	c	Grass	2.5	"	1904
	20	"	c	"	5.0	"	1937
	21	"	c	"	10.0	"	1952
	22	11-20, 21	d	AC	2.5	"	(2015)
	23	"	d	"	5.0	"	(2030)
	24	"	d recorded	"	10.0	"	(2045)
D	25	1-10, 21	e	Grass	10.0	11-18-79	1604
	26	"	e	"	5.0	"	1618
	27	"	e recorded	"	2.5	"	1631
	28	11-20, 21	f	AC	2.5	"	(1720)
	29	"	f	"	5.0	"	(1734)
	30	"	f recorded	"	10.0	"	(1748)
E	31	1-10, 21	e	Grass	2.5	11-18-79	1829
	32	"	e	"	5.0	"	1842
	33	"	e	"	10.0	"	1856
	34	"	e	"	2.5	"	1912
F	35	"	g recorded	"	10.0	11-19-79	0436
	36	"	g	"	5.0	"	0456
	37	"	g	"	2.5	"	0512
	38	11-20, 21	h	AC	2.5	"	(0535)
	39	"	h	"	5.0	"	(0550)
	40	"	h recorded	"	10.0	"	(0605)
G	41	1-10, 21	g	Grass	2.5	"	0637
	42	"	g	"	5.0	"	0651
	43	"	g	"	10.0	"	0706
	44	11-20, 21	h	AC	2.5	"	(0725)
	45	"	h	"	5.0	"	(0740)
	46	"	h	"	10.0	"	(0755)
H	47	1-10, 21	g	Grass	2.5	"	0838
	48	"	g	"	2.5	"	0901
	49	"	g	"	5.0	"	0916

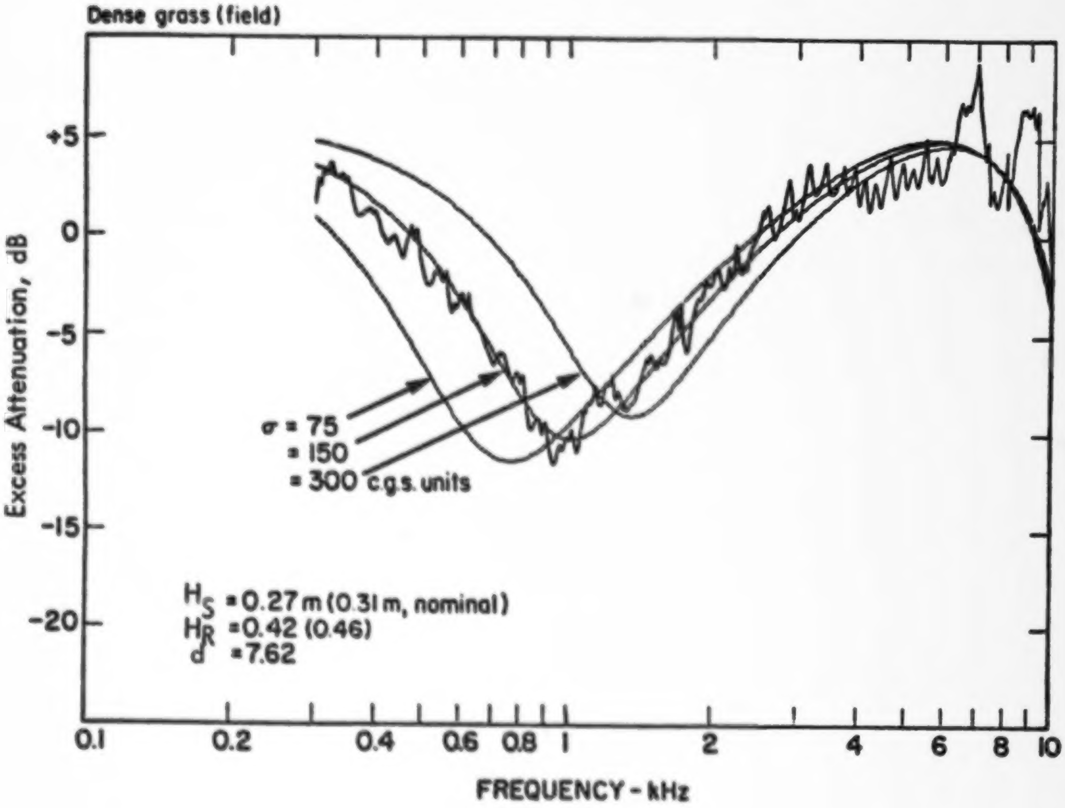
*Ambient data were analyzed from one of several recordings made during each session.

**Times of runs in parentheses are estimates. All times are Eastern Standard Time (EST).

***Nominal source heights. Actual height of acoustic source was 0.42 m higher for frequencies of 50 to 500 Hz and 1 m higher for frequencies above 500 Hz.


S
R
H_S
H_R
β
d
H_S = 0.31 m (1 ft) H_R = 0.46 m (1.5 ft) d = 7.62 m (25 ft)

(a) Test Configuration



(b) Test Data Over Dense Grass

Figure 17. Illustration of Simple Field Technique for Indirect Measurement of Ground Impedance by Matching Observed EGA Frequency Response to Value Predicted by Theory from Flow Resistance (Data from Reference 6).

mouth of the "point" source. This feedback signal was derived from a 1.27 cm microphone located immediately adjacent to the tube opening. Utilizing this technique, indirect measurements of ground impedance were obtained at two locations over the grassy surface near microphones 1 and 2. For this program, it was convenient to alter the geometry employed from that shown in Figure 17(a) so that the source height H_S was 15.2 cm (6 in.), the separation distance, d, was 244 cm (96 in.), and the receiver height H_R was 30.5 cm (12 in.).

3.3 Weather Measurement System and Measurement Procedures

Three different systems were employed for acquisition of weather data during this program; a 10 m weather tower, a 0 to 7 m weather profiler, and a 0 to 100 m balloon profiler.

3.3.1 10 m Tower

This basic weather measurement system was mounted on a 10 m tower and measured wind speed and direction, temperature, relative humidity and atmospheric pressure. This tower was located in the vicinity of the instrumentation vans which housed the data acquisition systems.

Each of the transducers employed on this 10 m tower system provided a digital signal output which was recorded in a multiplex fashion every 5 sec on the time code channel of the tape recorder committed to the microphone measurements over grass. Thus, these weather data were obtained only for the latter runs. However, as illustrated later, this did not prevent a problem in making good estimates of weather conditions at 10 m for the other runs over asphalt concrete.

3.3.2 7 m Weather Profiler

A weather sensing package consisting of a wind speed, temperature and relative humidity sensor was mounted on an automatic traversing mechanism to probe the lower 7 m of the atmosphere. The weather data and a time code signal were printed out, in the field, through a desk-top printing calculator. These data were later entered, manually, into a weather data analysis program. The weather sensing unit, manufactured by Atmospheric Instrumentation Research Co. was a model TS-2A Tethersonde System which provided a signal output from each transducer about every 5 sec. The profile unit was traversed on a motorized rack and pinion mechanism up and down over a 7 m span in a time period for each traverse in one direction of about 15 minutes.

For each such 7 m traverse, the instrumentation package was halted for a period of 60 to 90 sec at 10 logarithmically-spaced vertical position increments and three to four samples of each weather transducer output were printed out.

The transducer package was a rectangular-shaped box about 0.05 m square which had a cup-driven anemometer located on top, 0.31 m from the base of the unit, and thermistor temperature sensors, located 0.24 m from the base. In all cases, the elevation datum points for this profiler refer to the base of the transducer package so that all weather profile elevations printed out and defined in this report should, strictly speaking, be increased by about 0.3 m. This 0.3 m bias in elevation was not considered significant for purposes of this program for two reasons: (1) As expected, the measured weather conditions were finally employed more as a qualitative gauge for grouping the acoustic data according to the generally quiescent weather conditions instead of attempting a detailed mathematical correlation of changes in EGA values with weather variables. The latter would have required many more measurement runs covering a wider range of weather conditions to achieve statistical accuracy. (2) As noted in the overall site plan in Figure 7, the true elevation of the site where weather data were obtained was actually about 0.3 to 1 m higher than the average ground elevations of the microphone arrays so that a bias error in elevation of 0.3 m is not considered significant for definition of weather profiles.

The time constants for the temperature (dry bulb) and relative humidity (wet bulb) transducers were about 5 and 10 to 15 sec, respectively. The time constant for the cup anemometer would be of the same order due to rotary inertia, so that the average of the three or four samples of data at each elevation increment represent a very good timed-smoothed measure of weather conditions at each elevation. These ground level weather traverses were conducted at times to roughly coincide with the acoustic measurement runs and, as noted earlier, at a position close to the instrumentation vans.

3.3.3 100 m Balloon Profiler

The same transducer system used for the 0 to 7 m weather profiler was removed from the latter apparatus and connected to an Atmospheric Instrumentation Research Co. 7 cubic meter helium filled, winch-operated balloon, Model TS-1BR-4. In this case, the transducer output signals also included wind direction. Output signals of wind speed, direction, dry bulb temperature and relative humidity (from wet and dry bulb temperature) were telemetered to the ground and printed out continuously on the printing calculator as the balloon ascended or descended. In the final analysis of these data, for each traverse, 15 to 30 sets of the above parameters were defined at equal time increments of about 30 sec over the 9 to 12 minute traverse time. These time increments corresponded to elevation increments which varied from about 0.3 m near the bottom or top of the balloon traverse to about 6 m near the middle of the traverse. Balloon elevation was determined directly from a marked nylon tether cord; since the balloon was operating in such low winds, this method was quite accurate.

Due to logistics problems, only four pairs of up and down balloon traverses were obtained during a portion of the first 16 valid EGA measurement runs. Nevertheless, the data obtained are considered reasonably typical of the weather profile up to 100 m for most of the runs which had a positive temperature gradient.

3.4 Data Analysis System and Procedures

3.4.1 Acoustic Data

All acoustic data obtained in the field were recorded on 14 track FM tape recorders using 2.54 cm (1 in.) magnetic tape. These data were reduced to obtain the received levels at each microphone position using the analysis instrumentation shown in a block diagram in Figure 18. The analysis instrumentation generated the following data output:

- Ambient background levels during each test,
- One-third octave band levels during each EGA run. This consisted of the energy mean noise level over the observation period, and the standard deviation about this mean for each run, microphone, and frequency band. To obtain these values, the output of the Bruel and Kjaer Real Time Analyzer, set to a time contant of "Fast Random," was sampled at a rate of 6.4 samples per second for a period of 15 seconds from the middle of the 20 seconds available. The resulting 96 samples of the rms level were used to obtain the energy mean and standard deviation of the received levels.

3.4.1.1 Ambient Background Noise Levels

The one-third octave band spectra of the ambient background noise level were measured by the Real Time Spectrum Analyzer using a "Slow" time constant and the resulting values printed out for application to the data analysis. As indicated in Table 6, an ambient background spectrum was recorded at some time during each test session

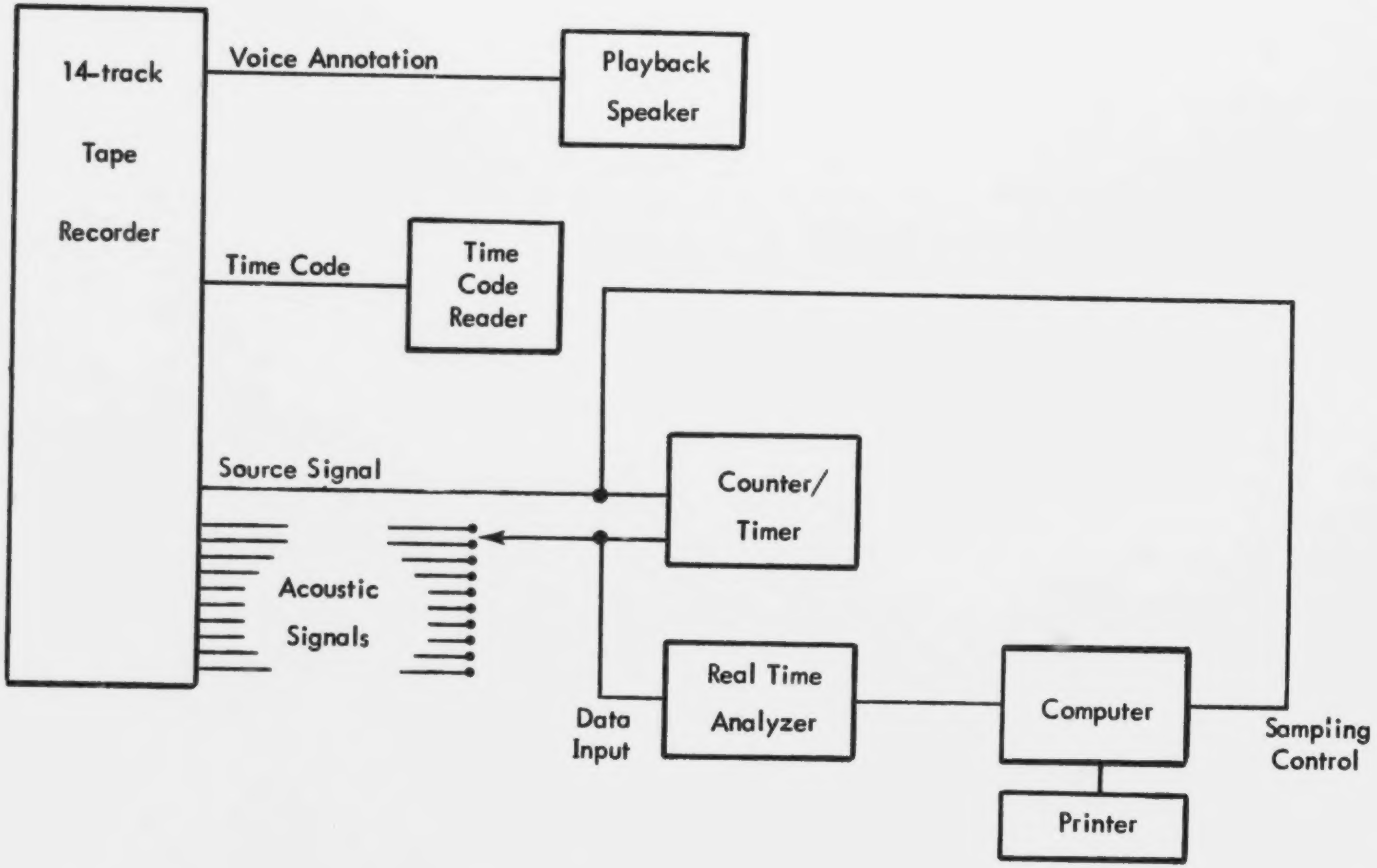

14-track
Tape
Recorder
Voice Annotation
Playback
Speaker
Time Code
Time
Code
Reader
Source Signal
Counter/
Timer
Acoustic
Signals
Data
Input
Real Time
Analyzer
Computer
Sampling
Control
Printer

Figure 18. Data Reduction Instrumentation Block Diagram.

which involved up to six EGA runs. This ambient measurement was found to be a sufficiently stable measure of the ambient level to be usable for all runs in that session employing the same microphone array. The one-third octave band levels L_e measured during each EGA run were then corrected for the corresponding ambient levels L_a for that run by applying the following usual energy correction.

$$L'_e \text{ (corrected)} = L_e - 10 \log \left\{ 1 \Big/ \left[1 - 10^{-(L_e - L_a)/10} \right] \right\} \quad ,\text{dB} \qquad (3)$$

In a very few number of cases (less than 1/4 percent), the ambient level had apparently changed from the time it was recorded during a given session to its value for a particular run within that session so that the apparent signal to ambient noise ratio (i.e., $L_e - L_a$) became negative. In such cases, the data were discarded as being unusable. For the remaining data, whenever the signal to ambient noise level was less than 5 dB (i.e., ambient correction indicated by the second term on the right side of Eq. (3) was greater than 1.6 dB), the "corrected" level was printed but flagged for identification in the final tabulated results. About 1 percent of the data were so flagged, with the majority of these occurring at high frequencies for the 675 m microphone position.

3.4.1.2 EGA Values

The noise levels at each microphone were measured using the system in Figure 18 with the real time analyzer set to the same one-third octave filter band used to generate the source signal. Thus, each measured level is a filtered one-third octave band level of the signal received from the source when the latter was driven by pink noise passed through a one-third octave band filter at the same frequency. This double filtering was essential, in this program, since it was necessary to drive the loudspeaker source with clipped input levels generating substantial distortion in the output. This is illustrated by the data in Figure 19 which shows a worst-case situation when the input signal was pink noise over a one-third octave band at 80 Hz. This figure shows the full one-third octave band spectrum of the electrical input to the loudspeaker (the lightly shaded area) for excitation by only one band of noise at 80 Hz, the spectrum of the measured acoustical output at the reference microphone (the open area), and the effective spectral content of this measured signal, after passing through the second one-third octave band filter, at 80 Hz, in the real time analyzer (the heavily shaded area). Clearly, this latter signal is free of any of the significant distortion products present at the power amplifier and at the output of the loudspeaker system.

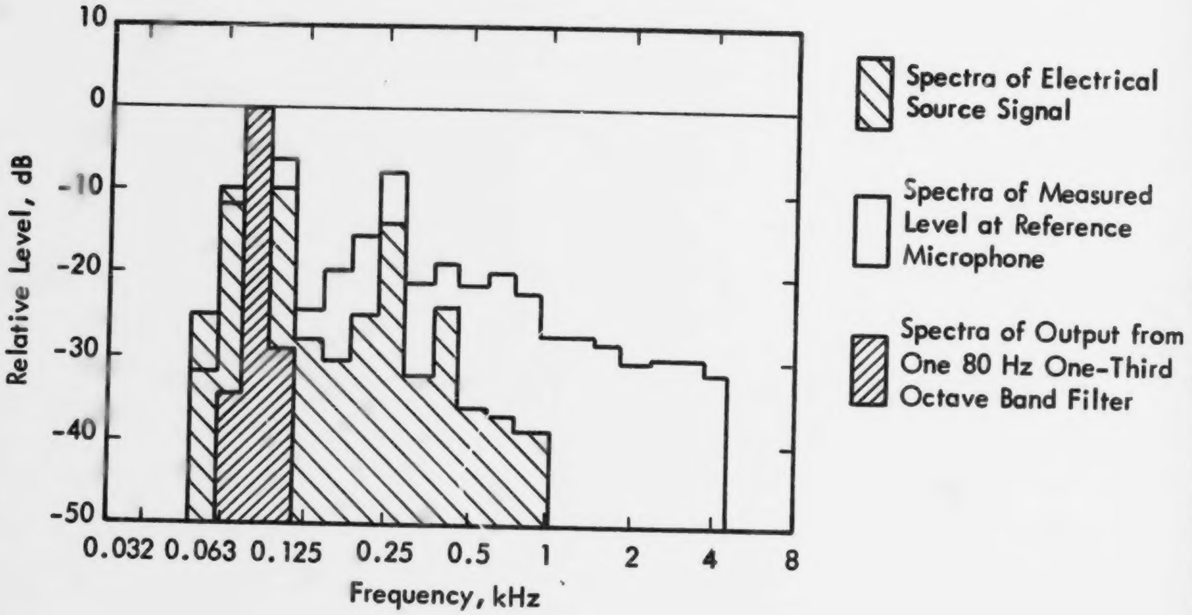


Figure 19. Relative One-Third Octave Band Spectra of: Electrical Input Voltage to Loudspeaker, Overall Level Measured at Reference Microphone at 5 m from Loudspeaker Source, and Output of the One-Third Octave Band Analysis Filter for System Excitation by One-Third Octave Band of Pink Noise at 80 Hz.

The final EGA values were computed, according to the flowchart in Figure 20, by the following steps:

1. Received signals corrected for recorder gain and microphone sensitivity (calibration) data to provide "as measured" noise levels,
2. Ambient background noise level corrections applied to these data as defined in the preceding section,
3. Atmospheric absorption loss and inverse square law spreading loss corrections applied to each microphone relative to the reference microphone.
4. The resulting levels which have been corrected for ambient noise, spreading loss, and atmospheric absorption loss, are subtracted from the reference microphone levels to obtain excess attenuation values.

That is, the EGA value for the ith band, A_{ei}, was given by:

$$A_{ei} = L_{oi} - \left[L'_{ei} + 20 \log (R/R_o) + \alpha_i (R - R_o) \right] \quad , \text{dB} \tag{4}$$

where L_{oi} = Reference level of the ith band at distance R_o,

L'_{ei} = Ambient-corrected level at distance R,

α = Atmospheric absorption coefficient of the ith band and average weather conditions for the propagation path at the time of the run.

The atmospheric absorption coefficients were computed according to the methods specified in Reference 15 for pure tones. As shown in Reference 16, the absorption loss for propagation of a one-third octave band of noise is within about 0.5 dB of the value for the pure tone at the center frequency of this band providing the product of the propagation path (in km) and the square of the frequency (in kHz)^2 is less than 10. In this case, at the farthest distance ($R \simeq 0.7$ km) and highest frequency ($f = 4$ kHz), this product is 11.2 so that, at the most, the error in EGA due to this second order effect will not be much greater than 0.5 dB at 4 kHz and 675 m and will be substantially less at all other frequencies and distances.

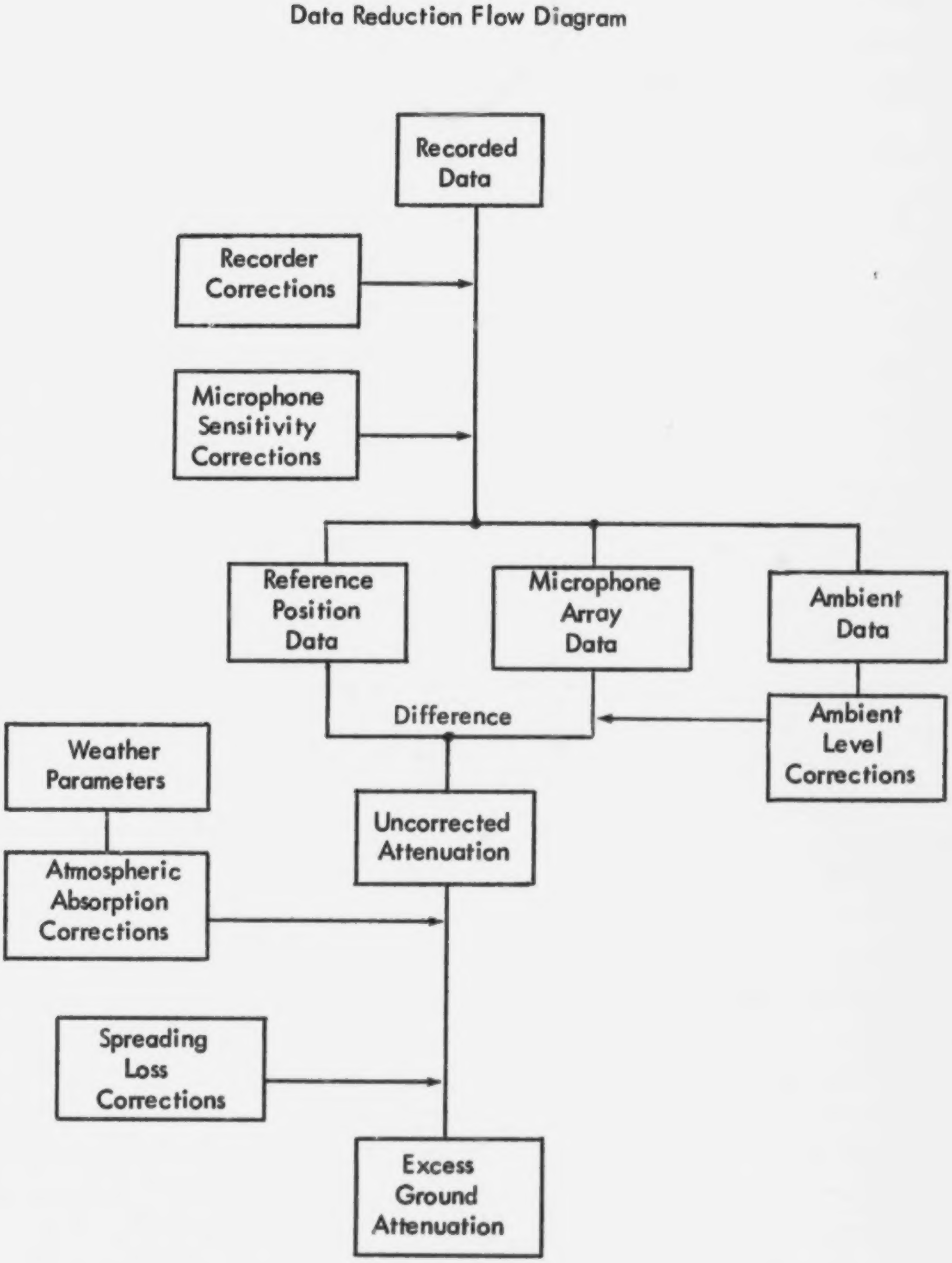

Data Reduction Flow Diagram
Recorded Data
Recorder Corrections
Microphone Sensitivity Corrections
Reference Position Data
Microphone Array Data
Ambient Data
Difference
Ambient Level Corrections
Weather Parameters
Uncorrected Attenuation
Atmospheric Absorption Corrections
Spreading Loss Corrections
Excess Ground Attenuation

Figure 20. Data Reduction Flow Diagram to Determine EGA by One-Third Octave Band Levels.

3.4.2 Weather Data Analysis

3.4.2.1 10 m Tower Data

These data, originally encoded in digital format, were also monitored on site to guide the selection of run times so as to achieve low wind speeds. The same data were recorded every 5 sec, only on the tape recorder for the runs over grass as explained earlier. These data were printed out upon playback of the data, and arithmetic average values computed for the duration of each of these runs.

3.4.2.2 7 m Profile Data

The actual digital printout of the data and corresponding time code, generated on site during the tests, were manually entered, by NASA personnel, into a NASA weather profile computer analysis program. This produced the type of computer-generated weather profile plots shown in Figure 21. The (+) data points connected with lines show the profile as the transducer system traveled upward from a datum elevation of 0 m (actually ~0.3 m above the ground as stated earlier). The (o) data points show the immediately following profile coming back down. The total round trip traverse time was 23.5 min in this case. These type of plots were then used to determine, by interpolation, the weather conditions desired at 7, 5, 2.5, 1.2 and 0 m for evaluation of mean wind speed, temperature and relative humidity and for vertical gradients in the first 7 m in wind speed and temperature.

3.4.2.3 100 m Balloon Profile Data

The same data analysis procedure employed for the 0 to 7 m profile data was also employed for the 0 to 100 m balloon profile data. A typical set of profile data from an "up" traverse and the subsequent "down" traverse from one of the four pairs of runs made is shown in Figure 22. In this case, the total traverse time for the 100 m round trip was nearly 23 min. Again, interpolation of the data from these plots was used to provide a limited set of values for this report.

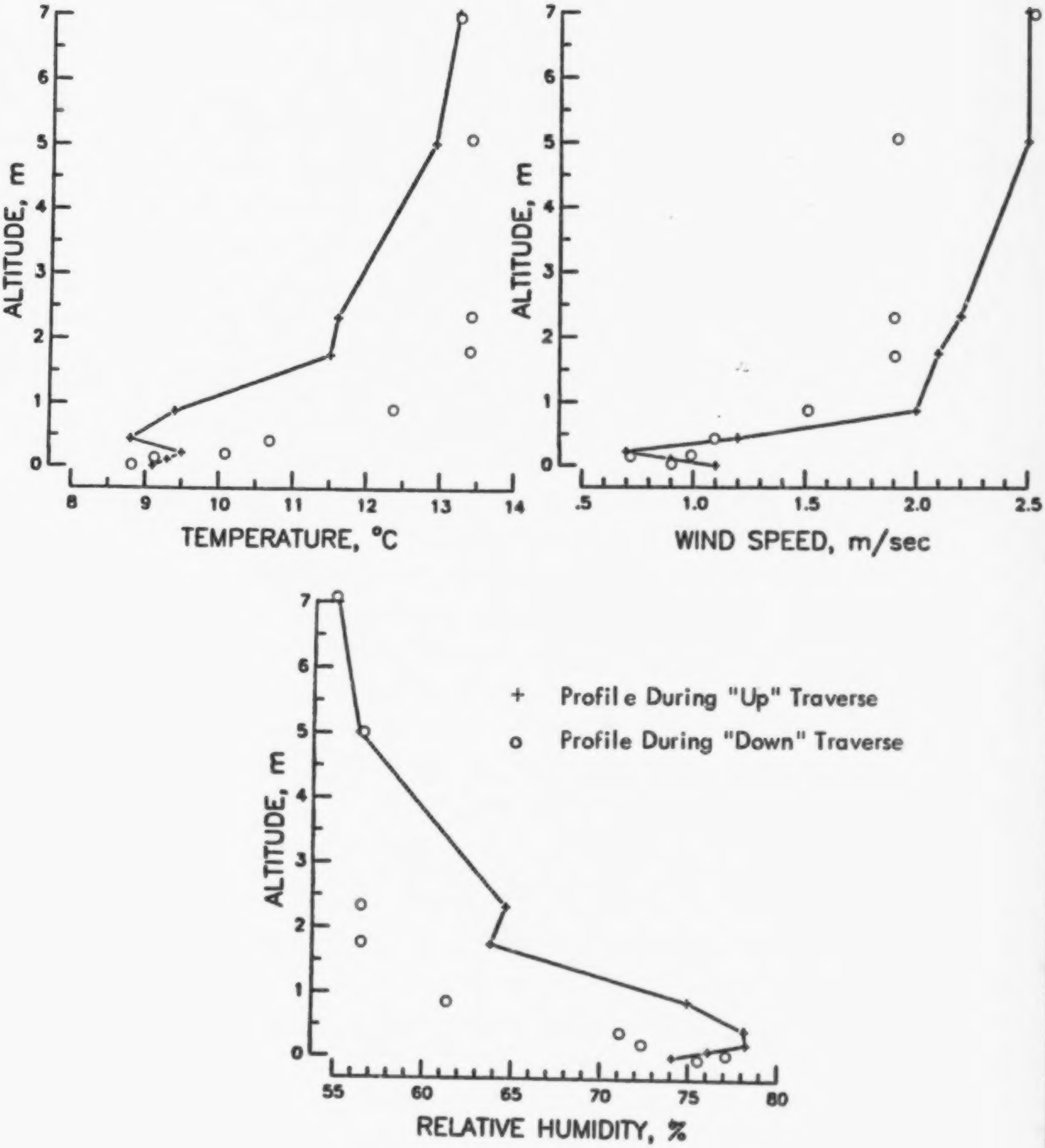


Figure 21. Example of One Pair of 7 m Weather Profile Traverses Showing the Values from an "Up" Traverse and a "Down" Traverse. Traverses No. 11 and 12, November 18, from 1748 to 1807, EST.

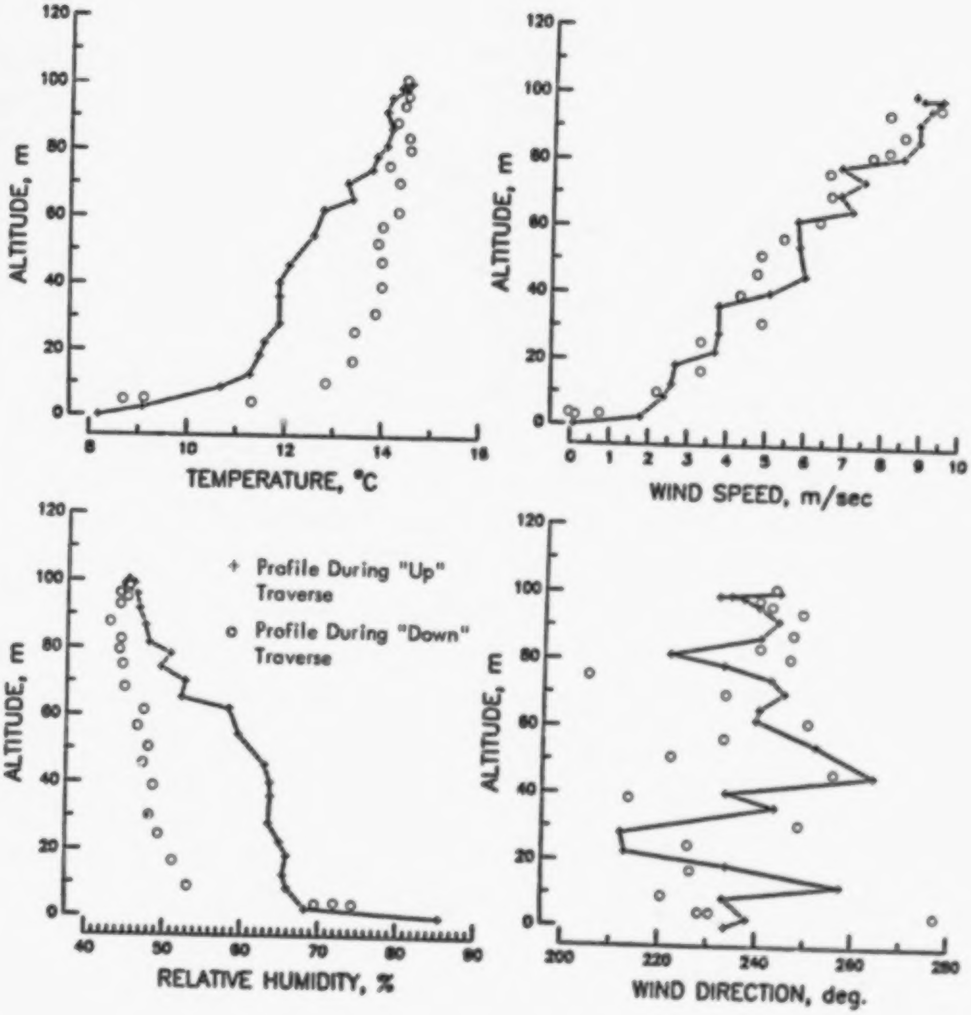


Figure 22. Example of One Pair of 100 m Weather Profile Balloon Traverses Showing the Values from an "Up" Traverse and a "Down" Traverse. Traverses No. 3 and 4 on November 17, from 1729 to 1752, EST.

4.0 RESULTS

The results of this EGA program are presented in this section in terms of

- Weather conditions (Section 4.1)
- Excess attenuation (Section 4.2)
- Acoustic ground impedance (Section 4.3)
- Fluctuations in transmitted levels (Section 4.4)

All remaining tables and figures are contained at the end of this report. The tables start on page 61 and the figures on page 75.

4.1 Weather During EGA Run

4.1.1 Wind Speed

The average weather conditions observed at the 10 meter tower during all the runs over grass are listed in Table 7. Figure 23 shows the time sequence of all the valid EGA runs along with the wind speed data from the 10 m tower measurement and the wind speed at 5 m from the 7 m profile data. The sequence and profile number of the latter are also identified in Figure 23. For reference, the sequence of the four pairs of balloon profile runs are also identified in this figure by the mean wind speed at 5 m from the latter profiles. All these wind speed data demonstrate the generally low wind speeds that were achieved for conduct of all the EGA runs. The numerical agreement between these various wind speed data are reasonable considering the limited range of the overall values and the differences in exact location and measurement time of each data point.

Table 8 lists the estimated wind speed data at 10, 7, 5, 2.5, 1.2 and 0 m for each EGA run. These data were obtained primarily from interpolation of the 0 to 7 m profile data. Underlined values at 10 m are from the 10 m tower; the remaining values at 10 m are extrapolated from the 7 m profile data.

As indicated in Table 8 in the column "Closest Profile Run," in some cases, wind profile data from two 7 m profile runs was used to estimate conditions applicable to an EGA run which occurred at a time between the two profile runs (see Figure 23). For some EGA runs, there were no adjacent 7 m profile runs and it was necessary to estimate the weather conditions from the closest profile run. Such cases are denoted by profile run numbers (and corresponding data) in parentheses. The last column in Table 8 lists the arithmetic average wind speed in the layer containing the direct sound propagation path from the source (at nominal height H_S) to the 1.2 m microphones. For example, for H_S = 10 m, the value listed in this column will be the average wind speed at 10, 7, 5, 2.5 and 1.2 m. (Recall that the true height of the acoustic source was 0.42 to 1 m higher than listed as discussed at the end of Section 3.2.1, page 32.)

4.1.2 Temperature and Relative Humidity

Table 9 presents the estimated temperature for each run in the same format as in Table 8 for wind speed. Relative humidity data for each run are shown in Table 10. In this case, only values at 10 m source height (H_S), 1.2 m and 0 m are listed. However, the average relative humidity values for the propagation path layer are based on the same detail as for Tables 8 and 9. These average temperature and humidity values over the propagation path layer (H_S - 1.2 m) were used to compute atmospheric attenuation values for all microphone positions (including those at 10 and 0 m) for each EGA run. A brief examination was made of worst case situations where the vertical gradients in temperature and humidity were highest. This indicated that the atmospheric attenuation at 2 kHz and at the farthest microphone at 675 m would deviate from the mean value computed as defined above by less than 1 dB if the temperature and humidity values had been taken at either the top or bottom of the propagation layer.

4.1.3 Average Weather Conditions for Each Source Height and Ground Surface

The data in Tables 8 through 10, along with the EGA run conditions in Table 6, have been used to construct, in Figure 24, the average vertical profiles of wind speed and temperature for all runs grouped according to the six categories of source height and ground surface.

Tables 11 and 12 list the average weather conditions for the propagation path for all runs in each of these six basic groups. In addition to listing average temperature, relative humidity and wind speed, these tables also list wind direction, and the following gradients in weather conditions over the lower 0 to 7 m layer.

- Average Vertical Gradient (dU/dZ) in Vector Wind Velocity from Source to Receiver.

  Based on an actual compass heading of 31° for Runway 04, which was used to establish the azimuth heading for the microphone arrays, the vector wind velocity U at any elevation in the direction from source to receiver was

$$\vec{U} = \text{Wind Speed} \cdot \cos\left[\text{Wind direction} - 180^\circ - 31^\circ\right], \quad \text{m/s}$$

It was assumed that wind direction (i.e., the direction from which the wind is blowing) did not change in the 0 to 7 m layer. Further, the wind velocity gradients listed in Tables 11 and 12 are average values computed from the arithmetic average of the gradients from 0 to 1.2 m, 1.2 to 2.5 m, 2.5 to 5 m, and 5 to 7 m, according to the data in Table 8. This simple smoothing process was selected as suitable for this program in lieu of a more complex approach such as describing the gradient of wind velocity by a power law (or corresponding logarithmic function). The latter approach is commonly applied in detailed studies of micrometeorology near the ground.[17]

- Average Vertical Temperature Gradient (dT/dZ).

  The same averaging process employed for wind velocity gradients was used for this gradient, based on the temperature profile data at 0, 1.2, 2.5, 5 and 7 m in Table 9.

- Average Vertical Gradient in Vector Sound Velocity $(\overrightarrow{dC}/dZ)$.

  This quantity is simply the sum of the gradients in vector wind velocity and sound velocity where the latter was computed from the temperature gradient. As indicated earlier by Figure 6 in Section 2.3, this total gradient in vector sound velocity from source to receiver was expected to have a major influence on the EGA data. As expected, this did, of course, turn out to be the case. The last series of EGA runs (Nos. 43 to 49) exhibited the lowest (in some cases, negative) values of this gradient. This is illustrated more clearly in Figures 25 and 26. Figure 25 shows the mean and standard deviation of the average temperature, wind speed, relative humidity and gradient in vector sound velocity for all the runs grouped according to source height and ground source. The corresponding values for the individual EGA Runs 43 to 49 are also shown, indicating that for these later runs, the gradient in vector sound velocity is usually well below the mean for all runs in the same group.

  A similar situation, though not as extreme, is shown by the scatter diagrams in Figure 26 which show the mean gradient of vector sound velocity for each run (with the same source height and ground surface) versus the corresponding vector wind velocity. In most cases, the values for Runs 43 to 49, denoted by the squares, are well-removed from the centroid of the values for the other runs. As will be shown later, EGA values for Runs 43 to 49 were generally very different than the average for the other runs.

The final parameter listed in Tables 11 and 12 is the Richardson's number. This parameter represents the ratio of energy extracted from atmospheric turbulence by buoyancy forces to the energy input to the turbulence by wind shear forces.[17] It is a measure of the relative stability of the atmosphere and has been shown, in a previous study, to have a strong influence on the relative magnitude of fluctuations on the level of a received sound propagating through the lower atmosphere.[18]

As defined in the table, the Richardson's number, R_i is given by

$$R_i = (g/T) \left[(dT/dZ) + 0.00986\right] / \left[dU/dZ\right]^2$$

where g = Acceleration of gravity, m/s^2

T = Mean absolute (dry bulb) air temperature, °K

dT/dZ = Temperature gradient, °K/m

dU/dZ = Gradient in wind speed, 1/s

0.00986 = Normal adiabatic lapse rate, °K/m

This parameter was computed for this program as a further aid in understanding the causes for variation in EGA values from run to run.

4.1.4 Weather Profiles from 100 m Balloon Traverse

Weather profile data from one of the four pairs of balloon traverses was shown earlier in Figure 22. A brief summary of these data is given in Table 13. The values listed were taken directly or interpolated from the plots generated by NASA from the field printout data as defined in Section 3.4.2. As indicated earlier in Figure 23, these traverses coincided, in time, with approximately 11 out of the first 15 EGA runs. Note that data are listed in Table 13 only up to an altitude of 80 m. Measurements from 80 to 100 m were also available for balloon profile runs 3 to 8; however, the latter do not differ substantially from the values at 80 m.

4.2 Excess Attenuation

4.2.1 Stability of Reference Level for Source

The method for calculating excess attenuation outlined in the preceding section required that the noise source have a constant output as it is moved in elevation from 10 m down to 5 or 2.5 m. This ignores any actual changes in radiating efficiency of the source as it approaches a ground plane. For a rigid ground plane, this effect becomes significant (i.e., the increase in source power output is greater than 1 dB) if the elevation of the source, treated as a monopole, is less than about 1/5 times the wavelength.[19] Since the lowest source elevation, 2.5 m, is nearly twice this much at the lowest frequency tested, this radiation loading effect was not considered significant.

The source level monitored by the reference microphone, 5 m from the source, when the source was located at a 10 m elevation over grass, was chosen as a convenient baseline reference condition for evaluating the stability of the source output. Table 14 lists the average value and standard deviation of this reference level at each frequency over all the runs corresponding to this configuration. Also listed are the deviations of the reference microphone output from this reference baseline when the source was at the other elevations over grass or over asphalt concrete. The data show a slight but consistent trend for slightly lower (less than 1 dB) sound output when the source was at 10 m over the asphalt concrete surface. At the other elevations, the measured source output clearly reflects the expected interference effects of the ground surface. This is quite apparent in the plot in Figure 27 of this variation in reference microphone levels.

Based on these data, the reference source levels at 10 m elevation were considered stable, within a standard deviation of less than 1 dB.

4.2.2 Excess Attenuation Data

As discussed earlier in Section 4.1, the weather conditions experienced during these tests seemed to fall, very roughly, into two groups - runs 9 through 42 for which the vertical gradient in vector sound velocity toward the microphones, was definitely positive and the remaining runs (43 to 49) for which this gradient was lowest, in some cases negative. (Note that these last runs were the only group initiated just after sunrise which occurred at approximately 0642 (EST) during the 3-day test period.) Furthermore, as suggested earlier, in general, the EGA values for these runs also appeared to differ significantly from the average values from the earlier runs. To evaluate this trend prior to averaging all the data, an arbitrary deterministic sample of EGA data was drawn from the individual run data. The sample consisted of the EGA values at 500 and 2500 Hz and for microphones at 112.5, 225 and 450 m from the source, and 1.2 m above the ground.

Figure 28 shows how the average of this sample of EGA data differs between the earlier (Nos. 9-42) and later (Nos. 43-49) runs. As indicated in the figure, the EGA values from most of the latter runs fall well outside the mid-range (mean ± one standard deviation) of the data from the earlier runs which had the higher sound velocity gradient. Thus, for this report, emphasis on data presentation has been placed on the earlier group of runs for which there were four to eight replications for each source height and ground surface.

A complete tabulation of the one-third octave band levels recorded at each microphone, corrected where necessary for ambient background levels and corresponding excess ground attenuation values, is contained in Appendix A. The data tables are grouped according to ground surface and source height for convenience. Whenever the ambient background noise was within 5 dB of the "as measured" test level before correction, the corresponding "ambient corrected" one-third octave band level and EGA value is identified by an underline. This occurred for about 1 percent of the 41 x 10 x 20 = 8200 EGA values. Unacceptable signal quality or questionable channel calibration problems, which occurred for an additional 128 (about 1.6 percent) data points, are also identified in the data tables. These latter data were not utilized further in this report.

The average EGA values for all of the earlier runs (Nos. 9 through 42), for each of the six basic ground surface/source height configurations, are listed in Table 15. These same average EGA data are plotted in Figures 29 in the sequence identified by the index on each figure.

For these figures, the EGA values for each of the two ground surfaces are plotted on the same scale but these scales are separated by 15 dB for each of the three source heights for convenient interpretation of the effect of ground surface and microphone position.

To illustrate the effect of source height, the same average EGA values at each of the three source heights are plotted in Figure 30 on the same scale for each ground surface at four microphone positions (H_R = 1.2 m, d = 112.5, 225, 450 and 675 m). The legend on this figure also lists elevation angle β for each microphone position. This is the same as the elevation angle β defined for the data in Reference 3 and is equal to the angle between a horizontal line, in the plane of the source and microphone which passes through the microphone, and the slant range line connecting the source and microphone. In terms of the terminology of Figure 1, this elevation angle, β , is given by

$$\beta' = \tan^{-1} (H'_S - H_R)/d$$

For this computation, the nominal source height H_S was changed to the approximate true source height H'_S by adding 0.7 m - an average of the 0.42 and 1 m correction for the source height at frequencies equal to or less than 500 Hz and greater than 500 Hz, respectively. (See end of Section 3.2.1, page 32.) Note that β is not the same as the grazing angle of the reflected ray, β , defined earlier in Section 2.0 of this report. The maximum EGA value does not systematically increase with this elevation angle for both ground surfaces as had been expected. There is, apparently, a more complex pattern for the change in EGA values with elevation angle and frequency for the average weather conditions involved for runs 9 through 42.

Finally, it should be noted that the standard deviation of the average EGA values presented in Table 15 and Figures 29 and 30, over all four to eight runs in each configuration, was usually less than 3 dB. When this standard deviation between runs was averaged over all frequencies and configurations, at each microphone position, it increased from an average of 1.1 dB at the closest position (28.1 m) to 3.2 dB at the farthest position (675 m). Specific values of this standard deviation between runs, for a specific frequency, ground surface, and microphone position, equalled or exceeded 5 dB in 84 out of the 1200 average EGA points available (10 microphone positions x 6 configurations x 20 frequencies). These specific cases are identified in Table 15 by an asterisk. Nevertheless, considering that there were from four to eight replications of each configuration for runs 9 through 42, the average EGA values, which are listed in Table 15 and plotted in Figures 29 and 30, are believed accurate to better than ±3 dB.

The EGA values for the remaining seven runs (43-49) differed from average values from the earlier runs at most positions. The individual data points for these runs may be found in the tables in Appendix A. A limited graphical display of the values observed for these latter runs is presented in Figure 31 for several microphone positions along with the average values of the corresponding earlier runs for the sake of comparison. As an example, note how the EGA values increased sharply at the 225 m position for those latter runs. A preliminary comparison with theoretical expectations[1] indicates that the EGA values for these latter runs (43-49) were perhaps closer than the earlier run data to values that would be predicted for a quiescent atmosphere. However, a more detailed comparative evaluation is required before one can firmly generalize. In any event, since the latter runs involved only one run in each source height/surface configuration (with the exception of the two runs 47 and 48 for the source at 2.5 m over grass), one cannot place as much confidence in these data as for the earlier runs.

4.3 Ground Impedance

Using the measurement system and techniques defined in Section 3.2.3.5, a brief indirect measurement was made of the acoustic impedance for the ground surface between microphone positions 1 and 2, over grass. The corresponding EGA data, plotted out in situ for this test, are shown in Figure 32. Figure 33 shows the theoretical values expected for the configuration employed in this field test, as a function of the adjustable parameter, specific flow resistance. The observed EGA data show a double peak in the EGA values - a pattern not predicted by the theory.[6, 7] However, a very rough approximation to the observed data would be provided by theory if the ground had a specific flow resistance of about 200 ±50 cgs rayls. The ground impedance corresponding to this flow resistance can be computed from the theory outlined in References 6 and 7. It is anticipated that a more accurate determination of acoustic impedance at the test site will be possible from a detailed comparison with theory for the actual EGA data from the closest microphone position 1 (over grass) or 10 (over asphalt concrete). The data at these positions were not substantially influenced by weather variations from run to run.

4.4 Fluctuations in Transmitted Sound Levels

For each run, the instantaneous sound pressures were monitored during the tests at each microphone position. Oscillographic records of the instantaneous signals were used for making visual determinations of signal quality at the time of the test. The 5-volumes of these time history records were retained for archival purposes only. Of more practical interest for this study is the time history of the rms sound pressure level measured with the Bruel & Kjaer Real Time Analyzer time constant set to "Fast Random." (This corresponds to an RC time constant of about 8 sec at 50 Hz decreasing logarithmically to a value of 0.2 sec for frequencies of 2000 Hz or more.) Figures 34 and 35 present just two examples of this type of information to illustrate situations for which the fluctuations in the received signal during each 20 sec transmission period was substantial (Figure 34)[*] and very low (Figure 35). It is worth noting that at the end of each 20-second signal transmission period, the signal received at the microphone also picks up the reverberant signals indicating reflections from the nearest buildings or possibly high altitude scatterers. According to the data in Figures 34 and 35, these "echoes" are, as expected, well below the primary received signals.

More than 400 such plots would have been retrievable from this program had there been a need to examine the fluctuation data in more detail. It will be sufficient for now to briefly consider the magnitude of the fluctuations in received level for a selected sample of the test runs and microphone positions. This magnitude is indicated qualitatively by the standard deviation of the 96 samples of the detected rms sound level measured during the 15 second signal analysis time (see Section 3.4.1) for each band of noise. Note, however, that the sampling period (1/6.4 SPS or 0.16 sec) is less than the RC integration time for all frequencies so that these 96 samples of the rms level were not necessarily statistically independent.

The trend in the fluctuating level is indicated by the data presented in Tables 16 and 17 and plotted in Figures 36 and 37. Table 16 lists this average standard deviation in rms sound level, averaged over all 20 frequency bands, for each of the test runs at the reference microphone position 5 m from the source and at all the 1.2 m microphone positions at 28.1 to 675 m from the source. The mean of these values over all except the reference position is shown in the next to the last column and the mean value over all runs at each microphone position is given by the last row in each section of the table. In addition, the Richardson's number (from Tables 11 and 12) is listed for each run in the last column. It will be recalled from Section 4.1.3 that this was a sensitive measure of the stability of the atmosphere - the higher the number, the higher the stability or lower the turbulence. Table 17 lists the average standard deviation at each frequency over a selected group of runs for the source at 5 m over grass and for microphone positions 4, 5 and 6 corresponding to microphone elevations of 0, 1.2, and 10 meters and a distance of 225 m from the source. The data selected for presentation of fluctuation levels were restricted to microphone positions and frequency bands for which the "as measured" signal-to-noise ratio was at least 5 dB.

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[*] The record of instantaneous noise levels for the 4 kHz band shown in Figure 34 is due to electrical noise and is not a valid acoustical signal.

Figure 36(a) shows the trend in the mean fluctuation level over all runs, represented by the corresponding mean standard deviation, as a function of distance from the source. Figure 36(b) shows the trend in the mean standard deviation, over all positions, as a function of the Richardson's number.

The fluctuations in received sound level tend to increase with distance (Figure 36(a)) and decrease with the average Richardson's number (Figure 36(b)) for the weather conditions prevailing at the time of the run, and increase somewhat with frequency (Figure 37). However, the variations in signal fluctuation levels with source-receiver distance, Richardson's number and frequency are not nearly as pronounced as observed in a previous study.[18] There are at last two reasons for this behavior. (1) The signal consisted of a band of noise instead of a sinusoidal signal as had been used in the earlier study, and (2) the rms detector time constant was relatively high at all frequencies, but especially at low frequencies thus tending to mask out unbiased trends in fluctuation level with frequency.

5.0 DISCUSSION

The results of this study provide a valuable addition to the necessary data bas for the experimental evaluation of excess ground attenuation. The data were obtaine primarily under weather conditions exhibiting a positive temperature gradient but ver low wind speeds. Under these conditions, the results appear to show significantly les excess ground attenuation than might be expected for an ideal quiescent atmosphere Nevertheless, the number of replications of the data possible under these condition ensures that they are a reliable measure of EGA under the conditions encountered. A more detailed evaluation of all the data from this program, and a comparison wit previous studies, is desirable before any detailed conclusions can be drawn from th results of this test program concerning agreement with theory or with results from previous studies of excess ground attenuation.

Table 7

Average Weather Conditions at 10 Meters During Measurements Over Grass Surface

Measurement Session	Run #	Date	Run Time*		Wind Dir., (deg.)	Wind Speed, (m/s)	Wind Speed Range, (m/s)	Barom. Pressure, (mm Hg)	Temp., (°C)	Rel. Hum., (%)
			Start	Stop						
A	9	11-17	0557	0612	255	3.1	2.3-3.6	763.8	5.6	73
	10	11-17	0621	0629	250	3.1	2.7-3.6	763.8	5.6	74
	11	11-17	0635	0649	250	3.1	2.7-4.0	763.8	5.6	78
B	13	11-17	1650	1658	267	1.8	0.9-2.7	760.5	13.4	45
	14	11-17	1704	1712	286	1.4	0.9-2.7	760.7	13.4	47
	15	11-17	1719	1730	255	2.7	2.3-3.6	760.7	13.4	49
C	19	11-17	1904	1912	241	2.7	2.3-3.1	760.7	11.8	59
	20	11-17	1937	1945	255	2.7	2.3-4.0	761.0	11.8	61
	21	11-17	1952	2006	250	3.1	2.7-4.5	760.7	12.0	60
D	25	11-18	1604	1612	273	1.8	0.9-2.3	762.3	18.5	35
	26	11-18	1618	1626	290	1.8	1.4-2.7	762.3	17.9	37
	27	11-18	1631	1639	280	2.0	0.9-2.7	762.3	16.8	39
E	31	11-18	1829	1837	273	0.0	0	763.0	12.9	62
	32	11-18	1842	1850	273	0.9	0.0-1.8	763.0	12.9	63
	33	11-18	1856	1904	273	0.3	0.0-1.4	763.0	12.9	64
	34	11-18	1912	1923	273	1.8	0.9-2.7	763.0	13.0	65
F	35	11-19	0436	0449	306	0.4	0.0-0.9	763.8	8.4	81
	36	11-19	0456	0504	306	1.4	0.9-1.8	763.8	8.4	81
	37	11-19	0512	0520	236	1.4	0.9-1.8	764.0	7.3	87
G	41	11-19	0637	0645	236	0.9	0.0-1.8	764.8	7.3	90
	42	11-19	0651	0700	236	0.9	0.0-1.8	765.0	7.8	91
	43	11-19	0706	0714	236	0.6	0.4-0.9	765.3	9.0	87
H	47	11-19	0838	0846	236	0.1	0.0-0.4	765.7	13.8	64
	48	11-19	0901	0909	237	0.9	0.4-1.4	765.8	14.8	66
	49	11-19	0916	0924	148	2.3	1.4-2.7	765.8	15.7	61

*Eastern Standard Time.

Table 8

Wind Speed Profile in First 10 m for Each Measurement Run. From 10 m Tower and 7 m Profile Runs

Measurement Session	Run #	Date (1979)	Closest Profile Run	H_S, m	Wind Speed, m/s						
					10 m*	7 m	5 m	2.5 m	1.2 m	0 m	Avg H_S - 1.2 m
A	9	11-17	2	10	$\underline{3.1}$	1.8	2.1	2.6	1.7	1.2	2.3
	10		2-3	5	$\underline{3.1}$	2.7	2.0	2.0	2.0	1.8	2.0
	11		2-3	2.5	$\underline{3.1}$	2.7	2.0	2.0	2.0	1.8	2.0
	12		3	2.5	$\underline{4.5}$	3.6	3.0	2.8	2.3	2.3	2.5
B	13		5	10	$\underline{1.8}$	1.0	0.3	0.8	1.1	0.2	1.0
	14		6	5	$\underline{1.4}$	1.0	0.7	0.8	0.4	0.7	0.6
	15		6-7	2.5	$\underline{2.7}$	1.7	1.7	1.9	0.9	0.6	1.4
	16		6-7	2.5	$\underline{1.7}$	1.7	1.7	1.9	0.9	0.6	1.4
	17		6-7	5	1.7	1.7	1.7	1.9	0.9	0.6	1.5
	18		7	10	2.0	2.4	2.7	3.0	1.5	0.4	2.3
C	19		8-9	2.5	$\underline{2.7}$	2.1	1.9	1.5	0.8	0.3	1.1
	20		8-9	5	$\underline{2.7}$	2.1	1.9	1.5	0.8	0.3	1.4
	21		9	10	$\underline{3.1}$	1.8	2.6	2.4	1.6	0.7	2.3
	22		10	2.5	$\underline{2.2}$	1.8	1.5	1.5	1.0	0.1	1.2
	23		(10)	5	(2.2)	(1.8)	(1.5)	(1.5)	(1.0)	(0.1)	(1.3)
	24		(10)	10	(2.2)	(1.8)	(1.5)	(1.5)	(1.0)	(0.1)	(1.6)
D	25	11-18	1-2	10	$\underline{1.8}$	1.9	1.4	1.7	0.7	0.5	1.5
	26		2-3	5	$\underline{1.8}$	1.8	1.5	1.6	0.5	0	1.2
	27		4	2.5	$\underline{2.0}$	1.6	1.0	1.3	0.7	0	1.0
	28		9	2.5	$\underline{1.6}$	1.8	1.9	1.5	1.3	0.4	1.4
	29		10	5.0	2.2	1.8	1.5	1.7	1.4	0	1.5
	30		11-12	10	2.9	2.5	2.2	2.0	1.8	1.0	2.3
E	31		5-6	2.5	$\underline{0.0}$	1.0	0.8	0.8	0.7	0.1	0.7
	32		7	5	$\underline{0.9}$	1.0	1.0	0.8	1.0	0.1	0.9
	33		8	10	$\underline{0.3}$	1.0	0.9	0.7	0.2	0.1	0.6
	34		(8)	2.5	$\underline{1.8}$	1.0	0.9	0.7	(0.2)	(0.1)	0.4
F	35	11-19	1	10	$\underline{0.4}$	0.1	1.0	0.3	0.1	0.1	0.4
	36		2	5	$\underline{1.4}$	0.9	0.5	0.8	0.6	0.1	0.6
	37		3-4	2.5	$\underline{1.4}$	0.8	0.4	0.6	0.7	0.1	0.6
	38		4-5	2.5	$\underline{0.7}$	0.4	0.1	0.2	0.2	0.1	0.2
	39		5	5	0.2	0.1	0.1	0.4	0.1	0.1	0.2
	40		6	10	0.1	0.1	0.1	0.1	0.4	0.1	0.2
G	41		7-8	2.5	$\underline{0.9}$	2.0	1.9	1.1	0.6	0.6	0.9
	42		8-9	5	$\underline{0.9}$	1.0	1.0	0.5	0.6	0.2	0.7
	43		9	10	$\underline{0.6}$	0.1	0.1	0.1	0.04	0.3	0.2
	44		(9)	2.5	($\underline{0.1}$)	(0.1)	(0.1)	(0.1)	(0.04)	(0.3)	(0.1)
	45		(9-10)	5	(0.1)	(0.2)	(0.5)	(0.3)	(0.4)	(0.1)	(0.4)
	46		(9-10)	10	(0.1)	(0.2)	(0.5)	(0.3)	(0.4)	(0.1)	(0.3)
H	47		10	2.5	$\underline{0.1}$	0.4	0.9	0.6	0.3	0.1	0.4
	48		11	2.5	$\underline{0.9}$	0.4	0.3	0.9	0.4	0.5	0.6
	49		12-13	5	$\underline{2.3}$	1.7	1.6	1.4	0.9	0.6	1.3

No. of Runs	H_S, m	Ground Surface	Average Wind Speed, m/s						
			10 m	7 m	5 m	2.5 m	1.2 m	0 m	Mean H_S - 1.2 m
12	10	Grass	1.59	1.10	1.20	1.23	0.78	0.44	1.18
		Asphalt	1.46	1.40	1.40	1.38	1.02	0.34	1.33
13	5	Grass	1.81	1.53	1.28	1.18	0.85	0.48	1.10
		Asphalt	1.28	1.12	1.06	1.16	0.76	0.18	0.99
16	2.5	Grass	1.56	1.37	1.18	1.14	0.73	0.42	0.94
		Asphalt	1.97	1.58	1.45	1.37	1.02	0.60	1.20
41	All	$\bar{\bar{x}}$	1.61	1.35	1.26	1.24	0.86	0.41	1.12
		$\sigma\ (\bar{x})$	0.25	0.20	0.15	0.11	0.13	0.14	0.14

*Underlined values from 10 m tower; remainder at 10 m are extrapolated, linearly, from 7 m profile measurements.

Table 9

Temperature Profile in First 10 m for Each Measurement Run. From 10 m Tower and 7 m Profile Runs

Measurement Session	Run #	Date (1979)	Closest Profile Run	H_S, m	Temperature, °C						
					10 m*	7 m	5 m	2.5 m	1.2 m	0 m	Avg H_S - 1.2 m
A	9	11-17	2	10	$\underline{5.6}$	5.5	5.3	5.1	4.5	2.9	5.2
	10		2-3	5	$\underline{5.6}$	6.1	6.0	5.8	5.2	4.2	5.7
	11		2-3	2.5	$\underline{5.6}$	6.1	6.0	5.8	5.2	4.2	5.5
	12		3	2.5	$\underline{6.8}$	6.7	6.6	6.5	5.9	5.5	6.2
B	13		5	10	$\underline{13.4}$	14.1	13.8	13.4	13.2	8.8	13.6
	14		6	5	$\underline{13.4}$	14.1	13.4	13.2	11.6	7.8	12.7
	15		6-7	2.5	$\underline{13.4}$	13.0	12.8	12.4	10.6	8.3	11.5
	16		6-7	2.5	$\underline{13.2}$	13.0	12.8	12.4	10.6	8.3	11.5
	17		6-7	5	13.2	13.0	12.8	12.4	10.6	8.3	11.9
	18		7	10	11.4	11.8	12.1	11.4	9.6	8.9	11.3
C	19		8-9	2.5	$\underline{11.8}$	11.9	10.9	10.4	8.9	7.0	9.7
	20		8-9	5	$\underline{11.8}$	11.9	10.9	10.4	8.9	7.0	10.1
	21		9	10	$\underline{12.0}$	11.9	11.9	11.1	8.7	7.8	11.1
	22		10	2.5	$\underline{12.2}$	11.9	11.7	11.7	11.2	7.0	11.5
	23		(10)	5	(12.2)	(11.9)	(11.7)	(11.7)	(11.2)	(7.0)	(11.5)
	24		(10)	10	(12.2)	(11.9)	(11.7)	(11.7)	(11.2)	(7.0)	(11.7)
D	25	11-18	1-2	10	$\underline{18.5}$	18.4	17.9	18.1	17.5	16.1	18.1
	26		2-3	5	$\underline{17.9}$	17.4	16.8	16.7	16.2	14.8	16.6
	27		4	2.5	$\underline{16.8}$	16.4	16.1	15.5	15.2	13.2	15.3
	28		9	2.5	$\underline{15.0}$	14.7	14.5	14.1	11.4	10.2	12.8
	29		10	5	15.1	14.7	14.4	13.9	12.4	8.7	13.6
	30		11-12	10	13.2	13.2	13.1	12.6	11.4	9.0	12.7
E	31		5-6	2.5	$\underline{12.9}$	12.2	12.2	11.2	10.9	8.6	11.1
	32		7	5	$\underline{12.9}$	12.5	12.5	12.1	9.9	7.5	11.5
	33		8	10	$\underline{12.9}$	12.5	12.5	12.0	9.5	7.1	11.9
	34		(8)	2.5	$\underline{13.0}$	(12.5)	(12.5)	(12.0)	(9.5)	(7.1)	(10.8)
F	35	11-19	1	10	$\underline{8.4}$	7.4	7.8	5.7	5.6	4.0	7.0
	36		2	5	$\underline{8.4}$	7.4	6.4	5.5	4.6	2.6	5.5
	37		3-4	2.5	$\underline{7.3}$	7.9	7.6	7.2	6.6	3.3	6.9
	38		4-5	2.5	$\underline{9.0}$	8.1	7.5	7.0	6.6	4.2	6.8
	39		5	5	9.6	8.3	7.4	6.5	6.1	4.7	6.7
	40		6	10	9.2	8.3	7.5	6.8	6.0	4.3	7.6
G	41		7-8	2.5	$\underline{7.3}$	5.7	5.3	4.5	4.2	3.4	4.3
	42		8-9	5	$\underline{7.8}$	7.8	7.2	6.1	6.3	4.6	6.5
	43		9	10	$\underline{9.0}$	9.8	9.4	8.5	8.6	6.2	9.1
	44		(9)	2.5	(10.4)	(9.8)	(9.4)	(8.5)	(8.6)	(6.2)	(8.6)
	45		(9-10)	5	(13.4)	(13.0)	(12.7)	(12.2)	(12.1)	(10.7)	(12.3)
	46		(9-10)	10	(13.4)	(13.0)	(12.7)	(12.2)	(12.1)	(10.7)	(12.7)
H	47		10	2.5	$\underline{13.8}$	16.2	16.0	15.8	15.5	15.1	15.6
	48		11	2.5	$\underline{14.6}$	16.2	16.6	16.6	16.6	17.4	16.6
	49		12-13	5.0	$\underline{15.7}$	16.7	16.5	16.7	16.9	17.4	16.7

No. of Runs	H_S, m	Ground Surface	Average Temperature, °C						
			10 m	7 m	5 m	2.5 m	1.2 m	0 m	Mean H_S - 1.2 m
12	10	Grass	11.4	11.4	11.2	10.6	9.8	7.6	10.9
		Asphalt	11.9	11.6	11.4	10.9	10.1	8.0	11.2
13	5	Grass	11.7	11.7	11.2	10.8	10.0	8.2	10.7
		Asphalt	12.7	12.2	11.8	11.3	10.5	7.9	11.2
16	2.5	Grass	11.7	11.8	11.6	11.1	10.2	8.8	10.7
		Asphalt	11.1	10.7	10.4	10.0	9.0	6.9	9.5
41	All	$\bar{\bar{x}}$	11.75	11.37	11.27	10.78	9.95	7.90	10.70
		$\sigma(\bar{x})$	0.54	0.50	0.48	0.45	0.52	0.63	0.63

*Underlined values from 10 m tower; remainder at 10 m are extrapolated, linearly, from 7 m profile measurements.

Table 10

Relative Humidity Profile in First 10 m for Each Measurement Run. From 10 m Tower and 7 m Profile Runs

Measurement Session	Run #	Date	Closest Profile Run	H_S, m	Relative Humidity, %[2]				Avg[3] H_S - 1.2 m
					10 m[1]	H_S	1.2 m	0 m	
A	9	11-17-79	2	10	73.0	73.0	87.0	87.0	77.0
	10		2-3	5	74.0	76.5	81.5	86.0	79.0
	11		2-3	2.5	78.0	78.5	81.5	86.0	80.0
	12		3	2.5	76.0	80.0	82.5	85.0	81.0
B	13		5	10	45.0	45.0	49.0	69.5	48.5
	14		6	5	47.0	52.5	61.0	78.5	56.0
	15		6-7	2.5	49.0	58.0	65.5	74.0	62.0
	16		6-7	2.5	52.0	58.0	65.5	74.0	62.0
	17		6-7	5	52.0	55.5	65.5	74.0	59.5
	18		7	10	60.5	60.5	69.5	69.5	62.0
C	19		8-9	2.5	59.0	66.0	71.0	82.5	68.5
	20		8-9	5	61.0	61.5	71.0	82.5	66.0
	21		9	10	60.0	60.0	71.5	80.5	60.5
	22		10	2.5	48.0	57.5	64.0	81.0	61.0
	23		(10)	5	(48.0)	(61.0)	(64.0)	(81.0)	(61.0)
	24		(10)	10	(48.0)	(48.0)	(64.0)	(81.0)	(57.5)
D	25	11-18-79	1-2	10	35.0	35.0	44.0	53.0	43.0
	26		2-3	5	37.0	44.0	49.0	59.5	47.0
	27		4	2.5	39.0	46.0	54.0	60.5	50.0
	28		9	2.5	49.0	50.0	64.5	74.5	57.0
	29		10	5.0	48.5	49.5	59.5	77.5	53.5
	30		11-12	10	53.0	53.0	65.5	75.0	58.0
E	31		5-6	2.5	62.0	69.0	68.5	79.0	69.0
	32		7	5	63.0	62.0	73.5	82.0	66.5
	33		8	10	64.0	64.0	77.5	86.0	66.5
	34		(8)	2.5	65.0	(66.0)	(77.5)	(86.0)	(72.0)
F	35	11-19-79	1	10	81.0	81.0	91.0	90.0	85.0
	36		2	5	81.0	95.0	96.0	99.0	94.0
	37		3-4	2.5	87.0	88.0	89.0	96.0	88.5
	38		4-5	2.5	82.7	88.5	90.0	96.5	89.0
	39		5	5	78.5	83.0	91.0	95.5	88.0
	40		6	10	73.5	73.5	93.0	97.5	84.5
G	41		7-8	2.5	90.0	96.0	95.0	99.0	95.5
	42		8-9	5	91.0	85.5	89.5	92.0	88.5
	43		9	10	87.0	87.0	84.0	88.0	80.5
	44		(9)	2.5	(72.5)	(82.5)	(84.0)	(88.0)	83.5
	45		(9-10)	5	(64.5)	(66.5)	(70.0)	(75.6)	68.5
	46		(9-10)	10	(64.5)	(64.5)	(70.0)	(75.6)	67.0
H	47		10	2.5	64.0	55.0	56.0	61.0	55.5
	48		11	2.5	66.0	56.0	54.0	53.5	55.0
	49		12-13	5	61.0	48.0	49.0	52.5	48.5

[1] Underlined values from 10 m tower; remainder at 10 m extrapolated, linearly, from 0 to 7 m profile measurements.

[2] Rounded to nearest 1/2% Relative Humidity.

[3] Avg between source height (H_S) and 1.2 m; includes values at 7, 5 and 2.5 m, not shown in this table.

Table 11

Mean Weather Conditions for Nominal Direct Propagation Path Over Grass Between Source and 1.2 Microphone

H_S, m	Run #	Temp., °C	RH, %	Wind Speed, m/s	Wind Direction, deg.	$d\vec{U}/dZ^{(1)}$, 1/s	$dT/dZ^{(2)}$, °C/m	$d\vec{C}/dZ^{(3)}$, 1/s	$R_i^{(4)}$
10	9	5.2	77.0	2.3	255	0.14	0.49	0.43	0.46
	13	13.6	48.5	1.0	267	0.09	1.03	0.70	1.37
	21	11.1	60.5	2.3	250	0.21	0.73	0.64	0.36
	25	18.1	43.0	1.5	273	0.12	0.45	0.39	0.22
	33	11.9	66.5	0.6	273	0.07	1.03	0.68	1.60
	35	7.0	85.0	0.4	306	<0.01	0.51	0.30	3.54
	43	9.1	80.5	0.2	236	-0.04	0.62	0.33	12.60
	Mean	10.9	65.9	1.2	266	0.08	0.69	0.50	2.9
	Std. Dev.	4.3	16.1	0.9	22	0.08	0.25	0.17	4.4
5	10	5.7	79.0	2.0	250	0.10	0.36	0.31	0.81
	14	12.7	56.0	0.6	286	0.01	1.21	0.73	17.3
	20	10.1	66.0	1.4	255	0.22	0.86	0.73	0.32
	26	16.6	47.0	1.2	290	0.07	0.47	0.35	0.13
	32	11.5	66.5	0.9	273	0.08	0.96	0.65	1.21
	36	5.5	94.0	0.6	306	-0.01	0.81	0.47	1.40
	42	6.5	88.5	0.7	236	0.11	0.50	0.41	1.15
	49	16.7	48.5	1.3	148	0.09	-0.14	-0.01	-1.00
	Mean	10.7	68.2	1.1	255	0.08	0.63	0.46	2.7
	Std. Dev.	4.6	17.7	0.5	49	0.07	0.42	0.25	6.0
2.5	11	5.5	80.0	2.0	250	0.11	0.36	0.31	0.81
	15	11.5	62.0	1.4	255	0.17	0.89	0.70	0.58
	19	9.7	68.5	1.1	241	0.26	0.86	0.77	0.34
	27	15.3	50.0	1.0	280	0.11	0.57	0.45	0.22
	31	11.1	69.0	0.7	273	0.08	0.64	0.46	0.81
	34	10.8	72.0	0.4	273	0.07	1.03	0.68	1.60
	37	6.9	88.5	0.6	236	0.12	0.88	0.65	1.70
	41	4.3	95.5	0.9	236	0.17	0.36	0.38	0.37
	47	15.6	55.5	0.4	236	0.17	0.19	0.28	0.19
	48	16.6	55.0	0.6	148	0.04	-0.22	-0.09	-0.75
	Mean	10.7	69.6	0.90	243	0.13	0.56	0.46	0.59
	Std. Dev.	4.3	14.9	0.5	37	0.06	0.39	0.26	0.71

(1) Gradient in vector wind velocity toward source (0 to 7 m).

(2) Temperature gradient (0 to 7 m).

(3) Gradient in vector sound velocity toward source (over 0 to 7 m).

(4) Richardson's number = $(g/T)\left[(dT/dZ) + 0.00986, {}^{\circ}C/m\right] / \left[dU/dZ, 1/s\right]^2$.

Table 12

Mean Weather Conditions for Nominal Direct Propagation Path Over Asphalt Concrete Between Source and 1.2 m Microphone

H_S, m	Run #	Temp., °C	RH, %	Wind Speed, m/s	Wind(5) Direction, deg.	$d\vec{U}/dZ$(1), 1/s	dT/dZ(2), °C/m	$d\vec{C}/dZ$(3), 1/s	R_i(4)
10	18	11.3	62.0	2.3	248	0.36	0.52	0.71	0.089
	24	11.7	57.5	1.6	250	0.25	1.00	0.85	0.33
	30	12.7	58.0	2.3	277	0.10	0.79	0.58	0.42
	40	7.6	84.5	0.2	236	< 0.01	0.68	0.41	>220
	46	12.7	67.0	0.3	236	0.03	0.40	0.27	14.4
	Mean	11.2	65.8	1.3	249	0.15	0.68	0.56	47.0
	Std. Dev.	2.1	11.1	1.0	17	0.15	0.23	0.23	97.0
5	17	11.5	62.0	1.4	248	0.19	0.89	0.70	0.67
	23	11.5	61.0	1.3	250	0.25	1.00	0.85	0.33
	29	13.6	53.5	1.5	277	0.15	0.88	0.67	0.23
	39	6.7	88.5	0.2	236	0.03	0.57	0.37	20.8
	45	12.3	68.5	0.4	236	0.03	0.40	0.27	14.4
	Mean	11.1	66.7	0.96	249	0.13	0.75	0.57	7.3
	Std. Dev.	2.6	13.3	0.61	17	0.10	0.25	0.24	9.7
2.5	12	6.2	81.0	2.5	250	0.15	0.22	0.28	0.21
	16	11.5	62.0	1.4	248	0.17	0.89	0.70	0.67
	22	11.5	61.0	1.2	250	0.25	1.00	0.85	0.33
	28	12.8	57.0	1.4	277	0.10	0.84	0.61	0.44
	38	6.8	89.0	0.2	236	0.05	0.70	0.46	9.18
	44	8.6	83.5	0.1	236	-0.04	0.62	0.33	12.6
	Mean	9.6	72.2	1.1	249	0.13	0.71	0.54	3.9
	Std. Dev.	2.7	13.8	0.9	15	0.08	0.28	0.22	5.5

(1) Gradient in vector wind velocity toward source (0 to 7 m).

(2) Temperature gradient (0 to 7 m).

(3) Gradient in vector sound velocity toward source (over 0 to 7 m).

(4) Richardson's number = $(g/T)\left[(dT/dZ) + 0.00986,\ ^{\circ}\mathrm{C/m}\right] / \left[dU/dZ,\ 1/s\right]^2$.

(5) Estimated from closest run over grass.

Table 13

Summary of Weather Profile Data from Balloon Traverses, Conducted on November 17, 1979

		Closest EGA Run	11	11	15	16	19	19	23	24
		Traverse No.	1	2	3	4	5	6	7	8
Elevation,	Weather Parameter	Start Time	6:33:03	6:44:17	17:29:14	17:41:39	19:02:16	19:14:08	20:30:11	20:47:17
m	-	Direction	Up	Down	Up	Down	Up	Down	Up	Down
5	Temperature	°C	5.7	6.1	9.7	11.6	9.8	12.0	10.5	11.5
	Wind Speed	m/s	2.5	1.6	2.0	0.6	1.7	1.5	1.3	1.1
	Direction	Deg	247	230	236	228	223	221	223	232
	Humidity	%	75.5	82.0	67.3	66.5	68.0	59.7	56.7	63.0
10	Temperature	°C	6.3	6.7	11.0	12.9	11.0	12.3	12.0	12.2
	Wind Speed	m/s	3.5	2.3	2.5	2.2	2.2	2.1	1.3	1.3
	Direction	Deg	219	232	240	220	225	226	235	223
	Humidity	%	73.1	75.8	65.5	53.4	60.5	58.0	53.7	60.6
20	Temperature	°C	6.7	6.8	11.5	13.5	12.0	12.8	12.6	13.7
	Wind Speed	m/s	5.8	3.6	3.0	3.3	3.0	3.2	2.1	3.2
	Direction	Deg	206	230	227	226	227	235	248	239
	Humidity	%	72.5	74.4	65.4	50.4	59.0	55.0	52.2	48.2
40	Temperature	°C	7.5	7.3	11.9	14.0	12.9	13.2	13.2	13.5
	Wind Speed	m/s	6.8	5.6	5.1	4.3	4.3	4.4	4.0	4.5
	Direction	Deg	218	223	235	220	234	252	247	257
	Humidity	%	71.5	73.4	63.6	48.5	54.9	52.3	49.2	48.8
80	Temperature	°C	8.5	8.4	14.0	14.6	13.8	14.2	14.1	14.4
	Wind Speed	m/s	9.6	8.5	7.7	7.8	7.1	7.3	7.3	8.3
	Direction	Deg	239	227	227	242	247	236	254	253
	Humidity	%	69.5	70.4	49.2	44.2	49.7	46.3	43.3	43.2

Table 14

Variation Between Reference Microphone Levels Measured at 5 m from Source

Surface Source Ht., Freq. Hz	Grass						Asphalt Concrete					
	10 m		5 m		2.5 m		10 m		5 m		2.5 m	
	L(1)	σ (2)	Δ (3)	σ (2)	Δ	σ	Δ	σ	Δ	σ	Δ	σ
50	96.9	0.5	1.5	0.6	2.1	0.7	-0.7	0.4	1.3	0.4	2.3	0.7
63	101.8	0.6	1.6	0.9	1.1	0.9	-0.6	0.3	1.4	0.5	1.7	0.8
80	106.0	0.4	0.6	0.8	1.2	0.8	-0.1	0.2	0.7	0.4	1.8	0.9
100	108.2	0.6	-2.4	0.3	-4.4	1.3	-0.3	0.3	-2.7	0.3	-3.0	1.3
125	109.8	0.6	1.9	0.5	-6.0	1.0	-0.3	0.4	1.6	0.4	-7.9	0.7
160	112.8	0.4	-1.3	0.5	-1.3	0.7	-0.4	0.3	-1.7	0.3	-3.1	0.5
200	113.1	0.6	0.5	0.7	1.4	0.4	-0.2	0.4	0.5	0.4	0	0.4
250	110.9	0.6	0.6	0.5	2.7	0.5	-0.3	0.2	0.5	0.4	2.7	0.3
315	106.2	0.5	-0.3	0.6	3.7	1.0	-0.1	0.5	-0.3	0.5	5.0	1.0
400	106.9	0.4	0.6	0.5	-0.2	1.0	-0.2	0.3	1.1	0.2	1.3	1.0
500	110.1	0.4	0.2	0.6	0.9	1.2	-0.3	0.5	0.4	0.4	3.2	1.2
630	116.2	0.4	-0.1	0.4	0.3	0.5	-0.2	0.4	-0.1	0.4	0.5	0.3
800	115.7	0.5	-0.1	0.4	-0.1	0.4	-0.2	0.4	-0.2	0.3	-0.2	0.4
1000	114.1	0.5	0.1	0.4	-0.1	0.5	0	0.4	0	0.3	0.6	1.0
1250	112.4	0.6	-0.1	0.5	-0.2	0.5	-0.2	0.5	-0.2	0.4	0.3	0.9
1600	111.7	0.7	-0.3	0.6	-0.3	0.7	-0.3	0.6	-0.5	0.3	-0.2	0.5
2000	111.3	0.5	0	0.4	0.1	0.6	-0.1	0.2	-0.1	0.2	0.1	0.5
2500	111.0	0.5	-0.2	0.4	-0.1	0.7	-0.3	0.3	-0.2	0.3	0	0.5
3150	109.8	0.6	0	0.5	0.1	0.7	-0.1	0.4	-0.1	0.4	0.2	0.6
4000	108.8	0.8	-0.2	0.5	-0.1	0.7	-0.5	0.5	-0.3	0.5	-0.1	0.6

(1) Mean one-third octave band level over all runs for source at 10 m over grass (#9, 13, 21, 25, 33, 35 and 43).

(2) Standard deviation of reference level for individual runs about mean.

(3) Difference in mean level of reference microphone for source at specified position and at 10 m over grass.

Table 15(a)

Average EGA, in Decibels, for Six Runs for Source at 10 m Over Grass (Excluding Run 43)

FREQ kHz	MIC 1	MIC 2	MIC 3	MIC 4	MIC 5	MIC 6	MIC 7	MIC 8	MIC 9	MIC 10
DIST, M	28.1	56.3	112.5	225	225	225	337.5	450	450	675
HT, M	1.2	1.2	1.2	0	1.2	10	1.2	1.2	10	1.2
0.050	-3.7	-4.5	-4.1	-6.1	-5.3	0.5	-6.6	-6.5	-1.4	-4.6
0.063	-2.2	-3.8	-3.7	-5.5	-4.5	5.0*	-4.7	-4.7	2.1	-4.0
0.080	-2.7	-4.3	-3.4	-4.2	-3.1	7.5*	-1.5	-2.4	6.0	-0.7
0.100	-1.1	-2.9	-1.5	3.7	5.1	6.3	1.4	3.0	5.2*	2.4*
0.125	2.3	-0.8	1.6	6.5	9.4	3.1	4.6	6.2	0.2*	7.2*
0.160	9.3	0.7	3.6	4.6	8.2	-1.0	5.6	4.6	-3.4*	9.4
0.200	12.0	5.7	8.3	2.7	11.2	-2.0	7.0	7.2	-3.0	9.4
0.250	0.9	14.7	15.3	1.9	14.5	1.8*	13.5	13.1	-2.5	3.9*
0.315	-2.8	5.2	9.4	1.9	7.7	-1.8	7.9	6.2*	-6.1	6.1*
0.400	-5.6	2.0	3.4	2.9	2.4	-1.4	1.4*	2.9*	-3.5	1.1*
0.500	1.6	0.5	6.2	9.8	7.0	5.1	6.7	6.0	3.6	2.8*
0.630	-1.2	-0.7	3.4	11.7	7.3	6.6	7.6	8.1	6.3	7.9*
0.800	-1.7	4.8	3.2	8.9	7.5	2.1	5.6	7.0	1.6	1.8
1.000	-0.1	-2.6	5.4	4.7	6.1	-1.1	5.3	4.8	-2.4	2.0
1.250	0.9	-2.2	-0.1	3.7	2.3	-1.4	-0.8	1.3	-3.9	-0.8
1.600	-0.8	0.1	1.7	4.3	5.5	0.1	5.2	5.5	-0.5	4.1
2.000	1.2	-0.5	3.3	3.1	4.5	2.3	5.6	5.0	2.0	5.5
2.500	-0.1	-1.9	2.4	2.8	5.9	2.1	6.3	7.5	2.0	6.8
3.150	0.3	-1.7	2.4	2.3	5.4	3.8	6.1	6.5	3.8	•••••••
4.000	0.9	-1.6	2.0	1.6	4.9	4.8	6.9	6.2	5.2	•••••••

Table 15(b)

Average EGA, in Decibels, for Four Runs for Source at 10 m Over Asphalt Concrete (Excluding Run 46)

FREQ kHz	MIC 11	MIC 12	MIC 13	MIC 14	MIC 15	MIC 16	MIC 17	MIC 18	MIC 19	MIC 20
DIST, M	28.1	56.3	112.5	225	225	225	337.5	450	450	675
HT, M	1.2	1.2	1.2	0	1.2	10	1.2	1.2	10	1.2
0.050	-3.8	-5.1	-6.0	-7.0	-6.1	-3.4	-8.6	-9.6	-6.8	-9.4
0.063	-2.6	-4.5	-5.9	-7.0	-6.1	-1.4	-8.2	-9.3	-5.5	-10.2
0.080	-3.4	-5.3	-6.3	-7.0	-6.0	0.6	-6.6	-8.0	-2.8	-9.8
0.100	-2.0	-4.1	-4.8	-3.8	-2.5	3.5	-1.6	-3.7	4.1	-4.8
0.125	0.5	-2.8	-3.7	1.3*	3.3*	1.1*	-1.1	-0.9	0.3	-3.6
0.160	4.9	-2.0	-2.9	-0.6	1.4	-3.2	-0.2*	-0.3	-4.5	-3.8
0.200	13.4	-0.6	-2.2	-0.5	2.3	-5.6	-1.9	-0.9	-7.1	-2.3
0.250	5.9	2.6	0.5	-2.7	3.1	-3.2	2.8	-0.1	-3.5	-1.3
0.315	-0.7	11.3	2.1	-3.2	4.6	-5.9	0.6	1.7	-8.7	-0.5
0.400	-6.1	10.3	10.8	-1.8	12.2	-3.9	8.9	6.9	-5.2	4.2
0.500	-3.6	0.3	9.9	2.5	12.8	2.3	15.4	12.8	1.8	13.3
0.630	3.0	-3.2	4.5	6.9	10.8	4.8	10.3	8.8	3.5	10.1
0.800	-3.3	-1.7	-1.4	2.2	3.2	-0.3	3.2	2.0	1.4	-0.9
1.000	1.3	2.7	-3.9	-0.4	0.9	-3.1	0.2	-2.7	-2.4	-2.7
1.250	-3.7	-4.5	0.9	-3.2	3.5	-4.4	1.8	0.7	-4.5	-2.2
1.600	-2.0	1.6	0.6	-0.3	4.1	-1.7	5.2	2.3	-0.8	4.8
2.000	-0.3	-2.8	-0.1	0.4	4.0	-0.6	5.2	3.0	0.8	3.0
2.500	-1.5	-2.2	-1.6	1.0	4.6	0.3	6.2	3.7	1.0	5.2
3.150	0.0	-1.8	-0.4	1.2	5.5	1.5	6.8	6.0	3.8	•••••••
4.000	-0.4	-2.4	0.1	1.3	5.1	2.1	7.5	4.5	2.2	•••••••

*Standard Deviation Between Runs ≥ 5 dB.

Table 15(c)

Average EGA, in Decibels, for Seven Runs for Source at 5 m Over Grass (Excluding Run 49)

FREQ kHz	MIC 1	MIC 2	MIC 3	MIC 4	MIC 5	MIC 6	MIC 7	MIC 8	MIC 9	MIC 10
DIST.M	28.1	56.3	112.5	225	225	225	337.5	450	450	675
HT. M	1.2	1.2	1.2	0	1.2	10	1.2	1.2	10	1.2
0.050	-4.4	-5.3	-5.3	-8.3	-7.4	-3.6	-9.5	-10.6	-2.5	-8.2
0.063	-4.4	-5.7	-6.2	-9.4	-9.3	-1.7	-9.5	-10.8	0.3	-7.4
0.080	-5.2	-6.4	-6.7	-10.0	-8.8	1.6	-8.8	-9.9	3.9	-5.4
0.100	-4.0	-4.9	-4.9	-7.1	-5.4	8.6	-4.8	-2.6	13.0	3.2
0.125	-1.6	-2.5	-1.5	-0.6	1.3	10.5	3.1	6.8	9.7*	14.9
0.160	-0.8	-2.2	0.9	2.1	5.1	6.8*	8.8	9.7	3.9*	12.0*
0.200	3.6	2.4	9.4	6.8	13.7	1.0	9.7*	9.8*	0.9*	10.6*
0.250	12.8	9.6	18.4	5.8*	17.7*	-2.9	12.5*	11.9*	0.6*	11.6*
0.315	7.1	13.6	13.5	2.6*	7.9*	-3.9	8.4*	6.2*	0.0*	8.1*
0.400	4.7	6.2	5.7	1.7	1.6*	-0.9	3.1*	0.3*	-0.4	2.7*
0.500	0.3	4.8	7.2	8.2	5.6	3.6	2.7	2.8	5.0	4.2
0.630	-1.3	2.8	6.9	13.8	8.7	6.7	6.5	6.5	7.2	5.9
0.800	5.1	-0.5	3.7	10.4	6.2	3.5	2.6	3.5	4.3	4.4
1.000	-1.2	1.4	3.7	7.1	4.5	-0.2	1.2	1.6	0.7	2.2
1.250	-1.8	1.2	1.8	5.2	3.0	-0.8	-1.2	-1.0	0.2	0.0
1.600	3.0	-1.0	3.4	3.7	4.2	1.0	4.9	3.8	3.0	4.9
2.000	0.5	2.5	5.5	4.0	4.9	2.4	6.3	4.4	4.7	7.3
2.500	-1.7	-1.2	3.9	4.6	5.8	2.1	5.8	5.1	5.1	8.1
3.150	-0.8	-0.6	5.0	4.3	5.9	1.9	6.7	5.9	6.4	7.2
4.000	-1.0	-0.9	5.1	3.7	7.3	3.0	6.4	6.6	*************	

Table 15(d)

Average EGA, in Decibels, for Four Runs for Source at 5 m Over Asphalt Concrete (Excluding Run 45)

FREQ kHz	MIC 11	MIC 12	MIC 13	MIC 14	MIC 15	MIC 16	MIC 17	MIC 18	MIC 19	MIC 20
DIST.M	28.1	56.3	112.5	225	225	225	337.5	450	450	675
HT. M	1.2	1.2	1.2	0	1.2	10	1.2	1.2	10	1.2
0.050	-4.9	-5.6	-7.1	-8.9	-8.1	-5.8	-10.9	-12.4	-9.5	-12.6
0.063	-4.5	-5.6	-7.5	-9.7	-8.9	-5.1	-11.8	-13.6	-9.2	-14.9
0.080	-5.5	-6.5	-8.4	-11.4	-10.3	-4.4	-12.4	-14.1	-7.9	-16.2
0.100	-4.7	-5.6	-7.4	-10.0	-8.9	-1.0	-10.7	-10.8	-2.2	-13.7
0.125	-3.1	-4.1	-5.9	-9.1	-6.7	2.9	-9.0	-8.7	2.6	-9.0
0.160	-3.4	-5.0	-6.6	-7.3	-6.0	2.6	-9.2	-7.7	0.5	-5.9
0.200	-2.2	-3.9	-4.0	-4.5	-3.6	1.2*	-6.4	-5.7	-2.1*	-2.7
0.250	0.1	-3.3	-1.4	-5.7	-1.9	-3.7	-3.8	-1.8	-7.6	-4.1
0.315	5.1	-1.4	2.8	-5.5	0.7	-3.7	-1.6*	-4.2	-7.7	-3.3
0.400	11.2	3.2	7.5*	-5.6*	4.3	-2.6	3.5	2.9	-7.1	2.6
0.500	0.5	11.2	12.9	1.0	11.4	2.2	10.9	9.0	-0.9	8.3
0.630	-3.2	6.4	12.7	5.9	9.7	6.4	8.5*	11.3	3.8	6.8*
0.800	-3.2	-0.6	2.4	-1.7	0.3	2.5	1.6	3.4	-0.5	0.5
1.000	2.4	-5.1	-3.2	-3.3	-2.4	-2.0	-5.7	-0.9	-3.4	-2.4
1.250	-3.5	-1.3	-5.0	-5.5	-2.2	-4.8	-4.8	-0.4	-5.1	-2.1
1.600	1.2	4.9	2.4*	0.9	4.6	0.2	0.8	1.6	-1.2	1.4
2.000	-2.7	-0.8	2.1	-0.9	1.0	-0.3	2.4	3.3	1.8	5.6
2.500	-1.9	1.4	0.3	-0.3	4.5	-0.4	0.5	3.6	1.2	2.7
3.150	-2.0	0.1	1.4	0.2	4.6	0.6	4.0	3.2	0.9	5.0
4.000	-1.6	0.6	1.9	0.5	5.5	-0.2	2.7	2.6	1.7	*******

*Standard Deviation Between Runs ≥ 5 dB.

Table 15(e)

Average EGA, in Decibels, for 10 Runs for Source at 2.5 m Over Grass (Excluding Runs 47, 48)

FREQ kHz	MIC 1	MIC 2	MIC 3	MIC 4	MIC 5	MIC 6	MIC 7	MIC 8	MIC 9	MIC 10
DIST. M	28.1	56.3	112.5	225	225	225	337.5	450	450	675
HT. M	1.2	1.2	1.2	0	1.2	10	1.2	1.2	10	1.2
0.050	-4.4	-5.9	-6.5	-8.3	-8.8	-6.4	-11.0	-11.8	-6.0	-10.7
0.063	-5.7	-6.7	-7.6	-9.6	-9.9	-5.2	-11.5	-12.3	-3.3	-9.4
0.080	-6.6	-7.9	-8.7	-11.3	-11.4	-3.2	-11.8	-10.6	-0.2	-8.1
0.100	-4.9	-6.1	-7.1	-9.1	-8.7	4.5	-7.9	-4.4	6.1	1.4
0.125	-1.4	-3.0	-4.0	-3.0	-2.2	13.0	1.7	5.4	10.4	14.5
0.160	-5.8	-7.7	-8.0	-4.2	-2.5	7.6	3.2	8.6	6.5	15.8*
0.200	-2.6	-3.5	-2.4	7.3	8.8	13.6	15.6	26.0*	13.2	21.9*
0.250	1.6	1.8	5.2	14.0	20.1*	3.9	21.6*	19.7*	3.8	13.8*
0.315	6.3	5.8	13.4	6.8*	10.0*	-3.0	8.4*	6.6*	-3.3	5.1*
0.400	12.3	10.6	10.6*	3.0*	1.2*	-3.8	0.1	0.9	-3.3	1.3*
0.500	5.2	7.4	6.8	6.0	1.4	3.1	2.2	1.9	2.2	2.3*
0.630	2.8	6.0	7.7	11.0	4.1	4.3	3.9	3.3	3.6	3.0
0.800	-1.5	-0.5	1.8	6.1	-0.5	3.1	1.5	4.1*	4.9	4.1
1.000	-2.5	-3.0	-1.1	6.8	2.1	-0.7*	1.5	1.3	-1.3	1.5
1.250	2.8	-0.3	0.7	2.8	-1.9	-0.2	0.9	1.2	-0.4	-1.3
1.600	0.2	2.0	1.7	2.5	-0.0	1.6*	3.0	3.0	0.5	2.4
2.000	-1.0	-1.3	3.0	3.5	4.3	1.1	3.7	3.6	3.1	3.9
2.500	-0.3	0.5	2.4	2.4	3.0	3.1	4.7	5.3	4.3	7.5*
3.150	-1.3	-0.8	3.8	4.6	4.9	2.0*	5.2	6.5	5.7	4.8
4.000	-2.3	1.0	5.3	5.6	6.8	3.3*	6.5	6.9*	7.9*	******

Table 15(f)

Average EGA, in Decibels, for Five Runs for Source at 2.5 m Over Asphalt Concrete (Excluding Run 44)

FREQ kHz	MIC 11	MIC 12	MIC 13	MIC 14	MIC 15	MIC 16	MIC 17	MIC 18	MIC 19	MIC 20
DIST. M	28.1	56.3	112.5	225	225	225	337.5	450	450	675
HT. M	1.2	1.2	1.2	0	1.2	10	1.2	1.2	10	1.2
0.050	-4.9	-6.1	-7.6	-9.0	-8.6	-9.0	-10.9	-12.9	-10.4	-12.1
0.063	-5.6	-6.9	-8.7	-10.6	-9.9	-9.1	-12.8	-14.9	-11.0	-15.4
0.080	-6.3	-7.6	-9.4	-12.2	-11.3	-9.1	-13.6	-15.9	-10.0	-16.8
0.100	-4.7	-6.0	-8.0	-11.5	-10.4	-5.9	-12.6	-13.1	-4.5	-14.8
0.125	-1.8	-3.4	-5.6	-9.0	-7.8	0.7	-9.7	-9.1	-0.2	-9.2
0.160	-6.5	-8.3	-10.8	-14.5	-13.2	-0.6	-14.3	-14.5	-3.4	-12.1
0.200	-4.9	-6.6	-8.7	-12.1	-11.1	6.5	-11.6	-11.2	5.4*	-8.9
0.250	-4.1	-5.9	-7.9	-11.3	-8.8	10.0*	-9.3	-8.9	8.1	-5.9
0.315	-4.7	-7.5	-8.8	-11.3	-9.4	0.9*	-9.2	-8.3	-0.2	-4.7
0.400	-2.1	-5.3	-5.9	-9.0	-5.7	-3.0	-3.7	-1.3	-3.0	0.8
0.500	8.3	7.8	6.3	-4.1	7.2	0.7	7.8	9.9	-1.7	11.4
0.630	8.1	10.1	13.6	0.8	8.8	4.9	11.9	9.5	3.9	12.3*
0.800	0.1	5.0	4.6	-3.1	0.1	0.6*	3.8	0.9	-0.6	2.0
1.000	-5.5	-2.8	-1.2	-6.2	-5.1	-2.1*	-4.1	-3.7	-2.8	-1.8
1.250	-5.0	-4.7	-4.5	-5.7	-5.7	-3.7*	-4.6	-3.3	-3.9	-3.0
1.600	1.1	-1.6	-1.1	-3.6	-2.8	-1.3	1.8	1.8	0.3	4.1
2.000	-0.6	2.3	4.4	-0.5	3.3	-1.7	2.6	3.8	1.3	3.7
2.500	-3.4	0.1	0.6	-0.6	1.4	1.1	3.2	4.0	3.8	5.4
3.150	-2.0	0.8	3.0	-1.1	0.3	-0.1	3.2	3.5	3.1	3.8
4.000	-0.9	1.4	2.2	-1.0	1.6	0.5	4.5	2.7	3.6	****

*Standard Deviation Between Runs ≥ 5 dB.

Table 16

Standard Deviation of RMS Sound Level, During 15-Second Test Period, Averaged Over All 20 Frequency Bands, at 1.2 m Microphone Positions and at Reference Microphone Position

Surface & Source Height	Run	Microphone Distance, m								Mean(1)	R_i(2)
		5	28.1	56.3	112.5	225	337.5	450	675		
Grass 10 m	9	0.64	0.78	0.96	1.26	1.45	1.72	1.71	2.26	1.45	0.46
	13	0.62	0.70	0.77	1.07	1.25	1.51	1.46	1.71	1.21	1.37
	21	0.69	0.99	1.19	1.25	1.91	1.81	1.75	1.55	1.49	0.36
	25	0.68	0.73	0.81	1.02	1.32	1.62	1.40	1.53	1.20	0.22
	33	0.62	0.73	0.78	0.86	0.91	0.94	0.85	1.00	0.87	1.60
	35	0.61	0.69	0.77	0.86	1.01	0.91	1.03	1.19	0.92	3.54
	43	0.61	0.73	0.72	0.77	0.89	0.95	0.89	1.01	0.85	12.60
	Mean	0.64	0.76	0.86	1.01	1.25	1.35	1.30	1.46	1.14	
Grass 5 m	10	0.66	0.96	1.03	1.24	1.37	1.27	1.63	1.64	1.31	0.81
	14	0.64	0.79	0.93	1.22	1.58	1.73	2.10	2.48	1.55	17.30
	20	0.66	0.96	0.89	1.06	1.19	1.39	1.55	1.75	1.26	0.32
	26	0.60	0.75	0.85	1.07	1.28	1.65	1.75	2.74	1.44	0.13
	32	0.63	0.71	0.76	0.91	1.00	0.98	0.96	0.99	0.90	1.21
	36	0.63	0.82	0.87	0.91	0.96	1.02	1.35	1.10	1.00	1.40
	42	0.63	0.73	0.81	1.03	1.10	1.05	1.25	1.40	1.05	1.15
	49	0.64	0.85	0.98	1.49	2.21	1.93	1.94	1.49	1.57	-1.0
	Mean	0.64	0.82	0.89	1.12	1.34	1.38	1.57	1.70	1.26	
Grass 2.5 m	11	0.70	0.90	1.13	1.37	1.37	1.24	1.59	1.61	1.32	0.81
	15	0.69	1.07	1.41	1.30	1.43	1.48	1.41	2.35	1.49	0.58
	19	0.64	0.87	1.00	1.03	1.11	1.08	1.15	1.32	1.08	0.34
	27	0.67	0.87	1.09	1.37	1.38	1.61	1.72	1.92	1.42	0.22
	31	0.68	0.88	0.89	1.03	0.94	1.23	0.96	0.96	0.98	0.81
	34	0.65	0.82	0.88	0.97	0.93	0.94	1.23	1.44	1.03	1.60
	37	0.66	0.77	0.83	1.11	1.12	1.06	1.21	1.18	1.04	1.70
	41	0.64	0.73	0.84	1.15	1.06	1.38	1.06	1.27	1.07	0.37
	47	0.67	0.69	0.84	0.95	1.83	-	1.04	1.81	1.19	0.19
	48	0.67	0.77	1.08	1.12	1.93	1.78	1.66	1.46	1.40	-0.75
	Mean	0.67	0.84	1.00	1.14	1.31	1.31	1.30	1.53	1.20	

(1) Mean for all distances except reference microphone position at 5 m.

(2) Richardson's Number for average weather conditions in propagation path (from Tables 11 and 12).

Table 16 (Concluded)

Surface & Source Height	Run	Microphone Distance, m								Mean(1)	R_i(2)
		5	28.1	56.3	112.5	225	337.5	450	675		
Asphalt Concrete 10 m	18	0.66	0.78	0.90	1.08	1.23	1.83	1.88	2.04	1.39	0.09
	24	0.64	0.87	1.10	1.26	1.50	1.58	1.69	1.93	1.42	0.33
	30	0.61	0.73	0.80	1.13	1.47	1.41	1.47	1.83	1.26	0.42
	40	0.60	0.67	0.75	0.79	0.81	1.25	1.13	1.19	0.94	>220
	46	0.64	0.74	0.73	0.79	0.93	1.15	0.80	0.85	0.86	14.4
	Mean	0.63	0.76	0.86	1.01	1.19	1.44	1.39	1.57	1.17	
Asphalt Concrete 5 m	17	0.66	1.01	1.01	1.38	1.33	1.48	1.51	1.55	1.32	0.67
	23	0.64	0.77	0.87	1.15	1.21	1.18	1.13	1.07	1.05	0.33
	29	0.65	0.78	0.81	1.01	1.35	1.44	1.50	1.80	1.24	0.23
	39	0.65	0.67	0.65	0.68	0.78	0.88	0.93	0.89	0.83	20.8
	45	0.62	0.67	0.73	0.88	0.98	1.15	1.04	1.15	0.94	14.4
	Mean	0.64	0.78	0.81	1.02	1.13	1.23	1.22	1.29	1.08	
Asphalt Concrete 2.5 m	12	0.72	0.97	1.19	1.56	1.78	1.74	1.74	1.88	1.55	0.21
	16	0.64	0.87	1.21	1.42	1.20	1.28	1.25	1.03	1.18	0.67
	22	0.67	0.88	1.25	1.40	1.27	1.41	1.36	1.26	1.26	0.33
	28	0.67	0.75	0.83	1.03	1.02	1.23	1.41	1.53	1.11	0.44
	38	0.66	0.71	0.71	0.81	0.81	0.90	0.88	0.88	0.81	9.20
	44	0.67	0.66	0.72	0.98	0.90	0.94	0.93	0.80	0.85	12.60
	Mean	0.67	0.81	0.98	1.20	1.16	1.25	1.26	1.23	1.13	

(1) Mean for all distances except reference microphone position at 5 m.

(2) Richardson's Number for average weather conditions in propagation path (from Tables 11 and 12).

Table 17

Standard Deviation of RMS Sound Level During 15-second Test Period, for Each Frequency Band, at Microphone Positions 4, 5 and 6 (H_R = 0, 1.2 and 10 m at 225 m) for Source at 5 m Over Grass, Averaged Over All Runs with Richardson's Number Between 0.2 and 2.0*

Freq., Hz	Mic 4		Mic 5		Mic 6	
	0 m		1.2 m		10 m	
	Mean	σ	Mean	σ	Mean	σ
50	0.66	0.05	0.64	0.05	0.64	0.11
63	0.84	0.09	0.80	0.07	0.74	0.09
80	0.72	0.08	0.72	0.08	0.74	0.11
100	0.72	0.08	0.76	0.11	0.86	0.18
125	0.84	0.05	0.84	0.05	1.20	0.40
160	0.96	0.36	1.04	0.32	1.10	0.19
200	1.26	0.34	1.46	0.32	1.06	0.15
250	1.06	0.15	1.04	0.24	0.96	0.11
315	0.80	0.07	1.00	0.07	1.08	0.31
400	1.08	0.22	1.08	0.19	1.08	0.11
500	1.06	0.30	1.02	0.33	1.00	0.21
630	1.12	0.26	1.02	0.23	0.68	0.15
800	0.96	0.33	1.06	0.39	0.86	0.23
1000	1.00	0.42	1.24	0.63	1.34	0.25
1250	1.08	0.65	0.92	0.28	1.48	1.30
1600	1.34	0.69	1.30	0.56	1.02	0.29
2000	1.38	0.74	1.46	1.18	1.28	0.60
2500	1.24	0.36	1.12	0.27	1.46	0.64
3150	2.52	0.94	1.98	0.63	1.54	0.63
4000	2.14	1.09	1.92	0.43	1.98	0.99

* Average for Runs 10, 20, 32, 36, 42.

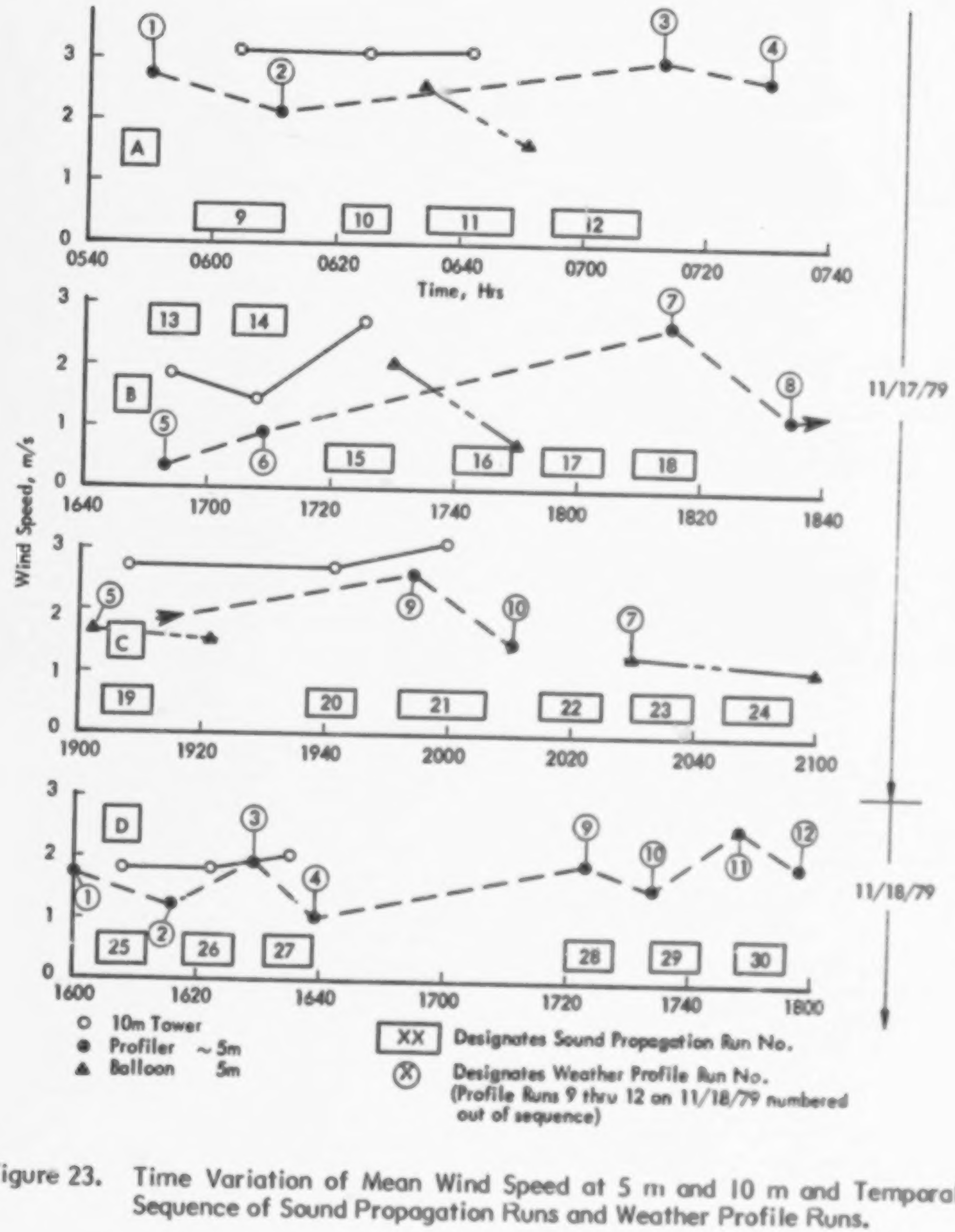

Figure 23. Time Variation of Mean Wind Speed at 5 m and 10 m and Temporal Sequence of Sound Propagation Runs and Weather Profile Runs.

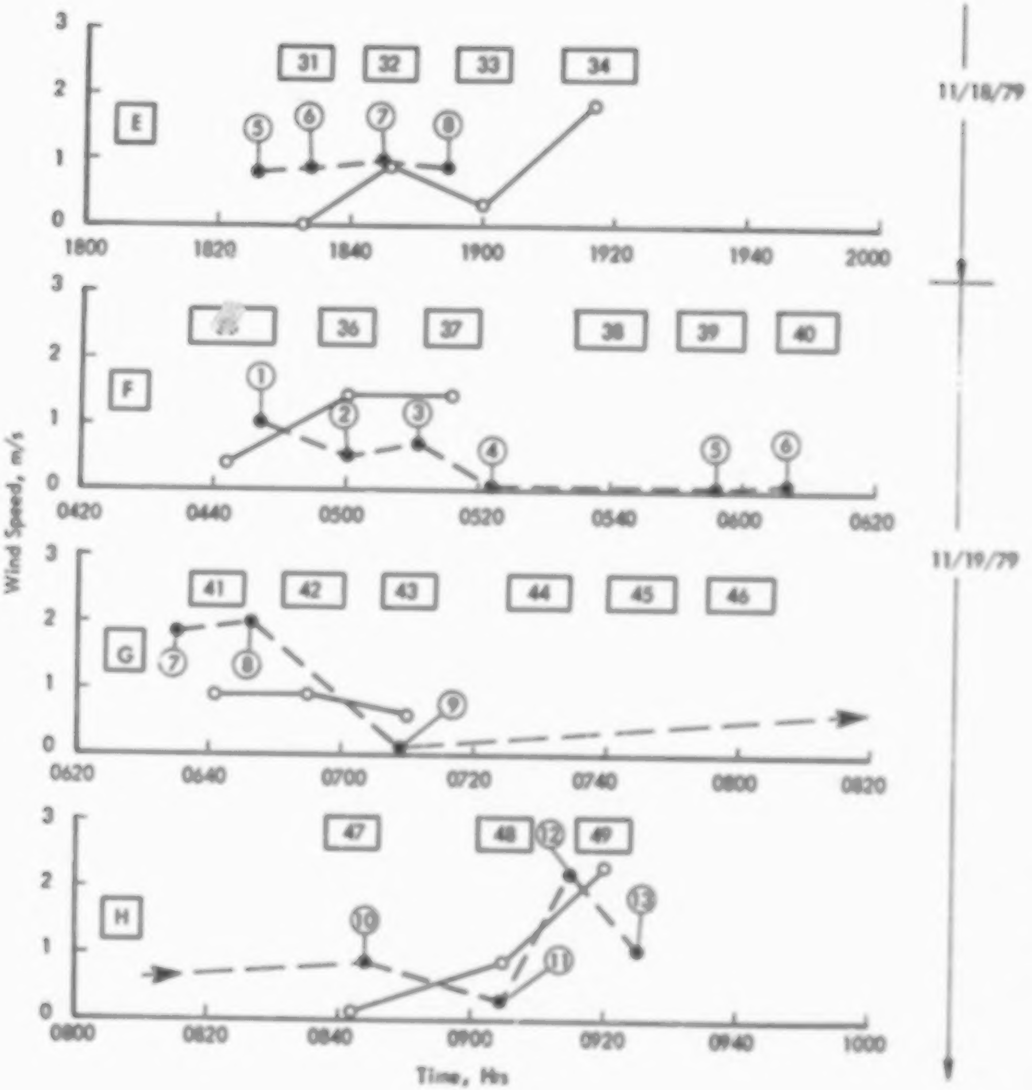

Figure 23 (Concluded)

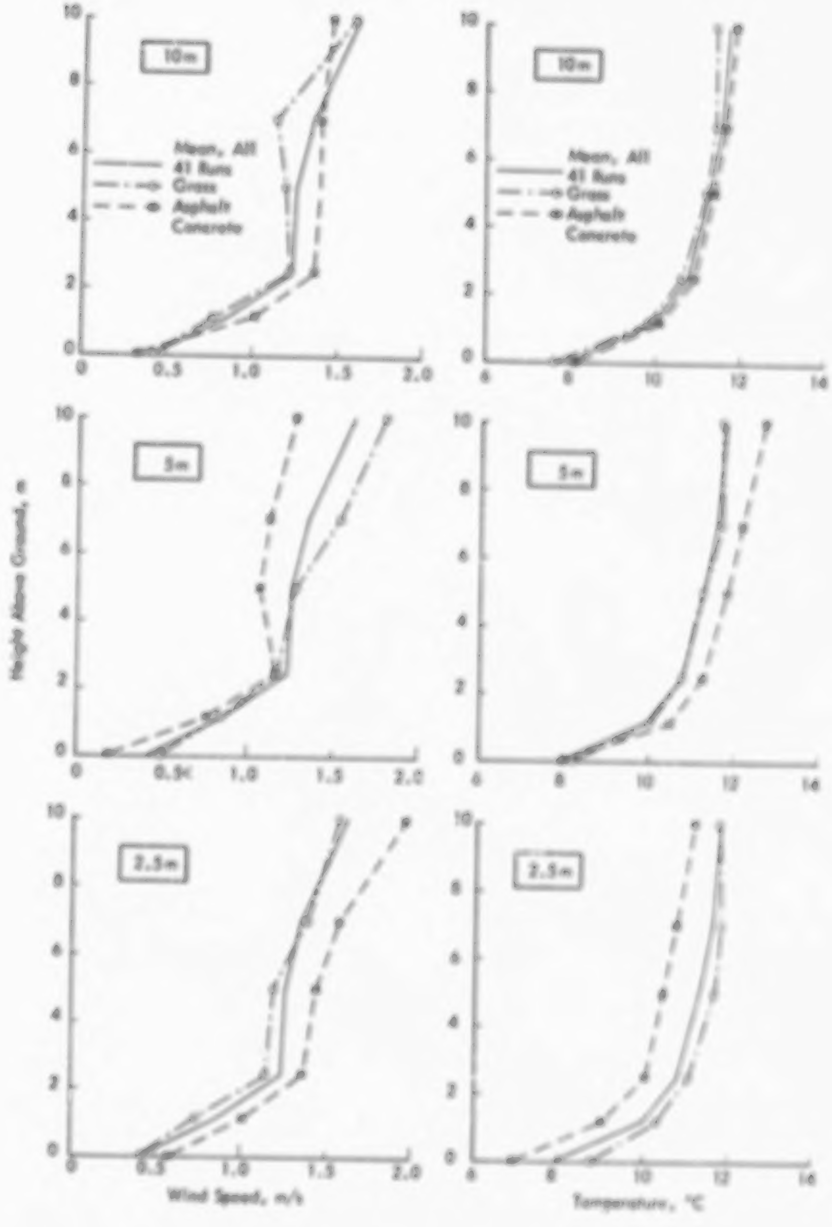

Figure 24. Average Vertical Profiles of Wind Speed and Temperature for All Runs Grouped According to Source Height and Ground Surface Compared to Overall Mean Profiles for All Runs.

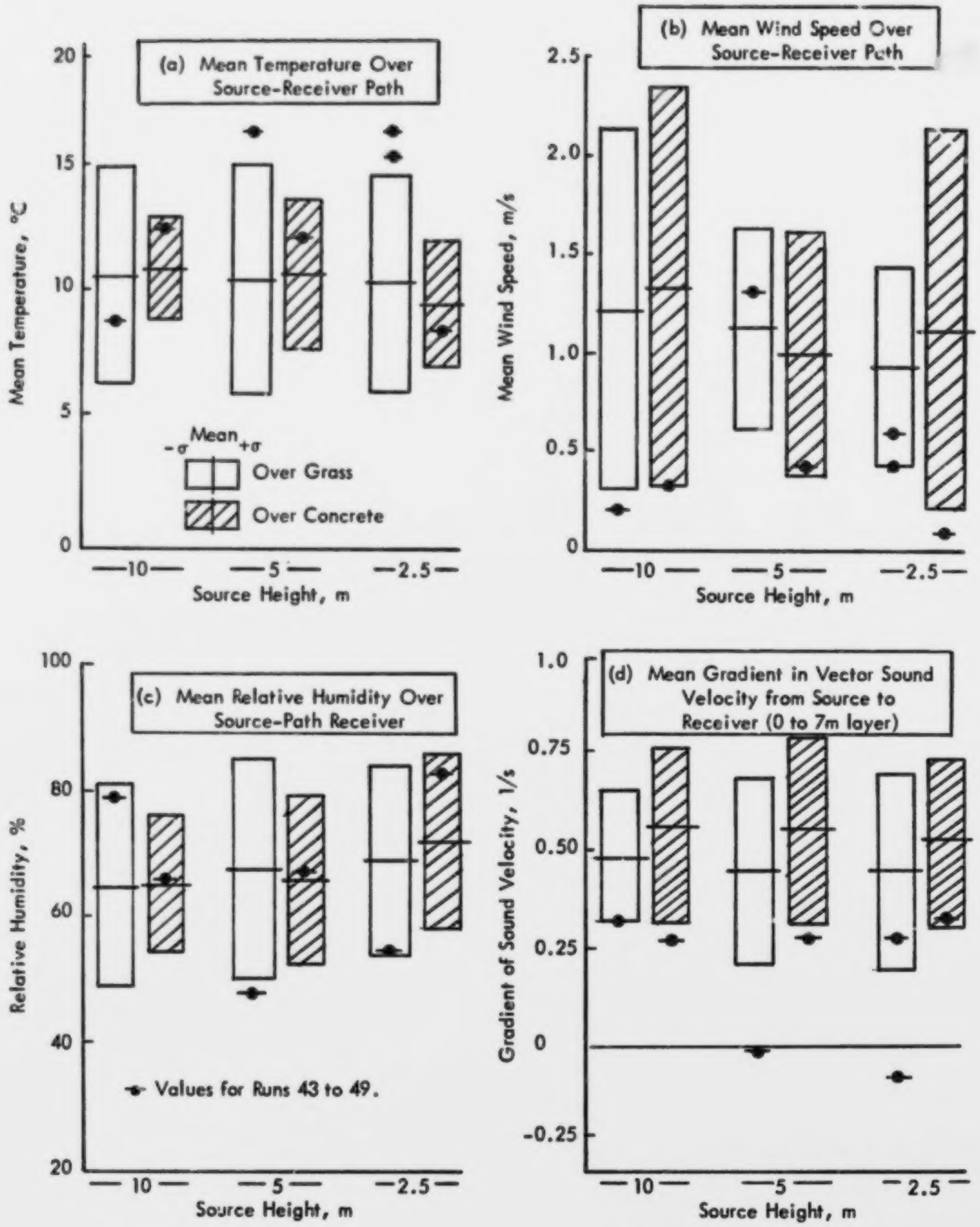

Figure 25. Mean and Standard Deviation of Four Basic Weather Parameters for All Runs Compared to Values, Denoted by ●, for Last Runs No. 43 to 49 Which Have Lowest Gradient in Vector Sound Velocity.

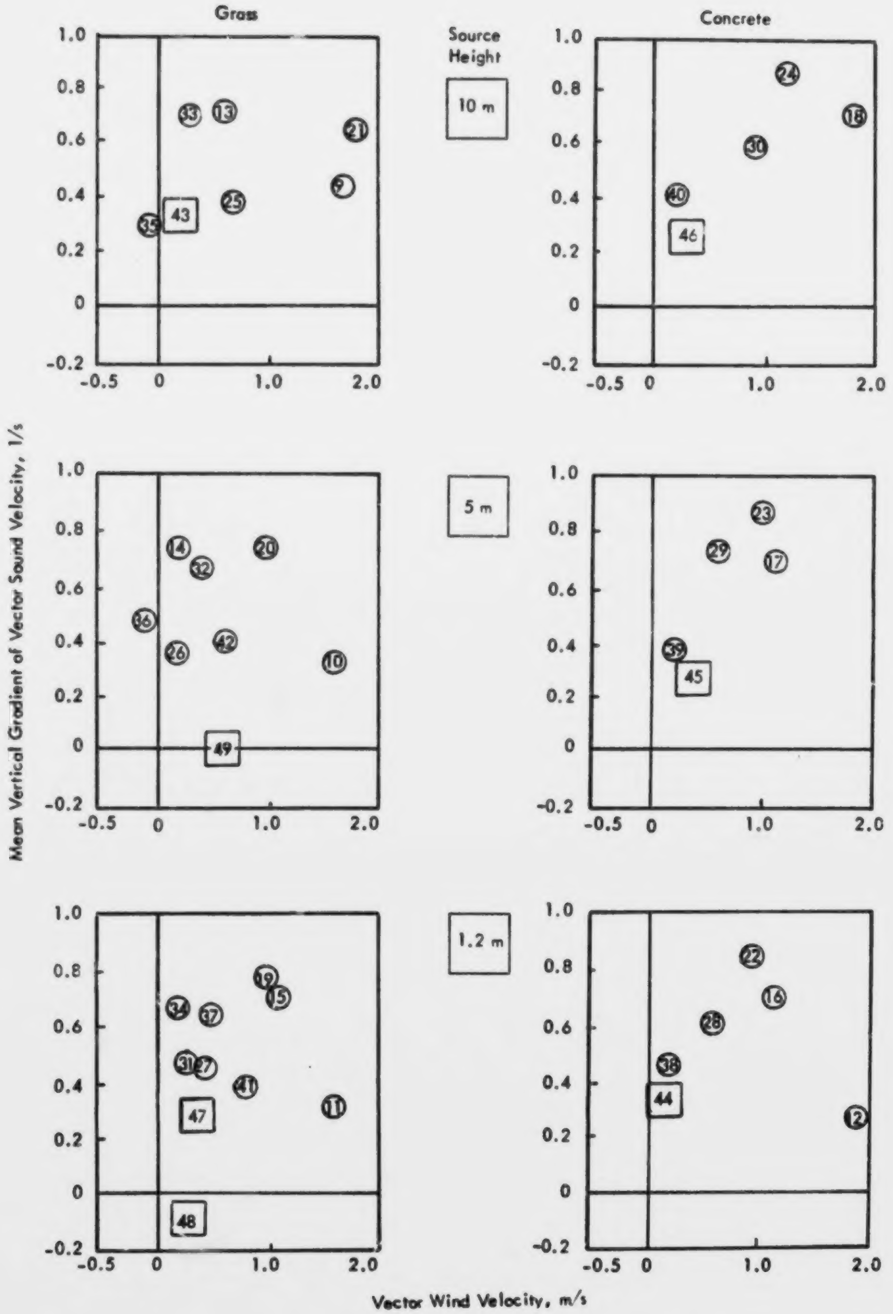

Figure 26. Mean Gradient of Vector Sound Velocity (from Source to Receiver) in First 7 m vs Vector Wind Velocity for All Runs Grouped According to Source Height and Ground Surface. Runs 43-49 are identified by boxes to show their relationship to the rest of the runs.

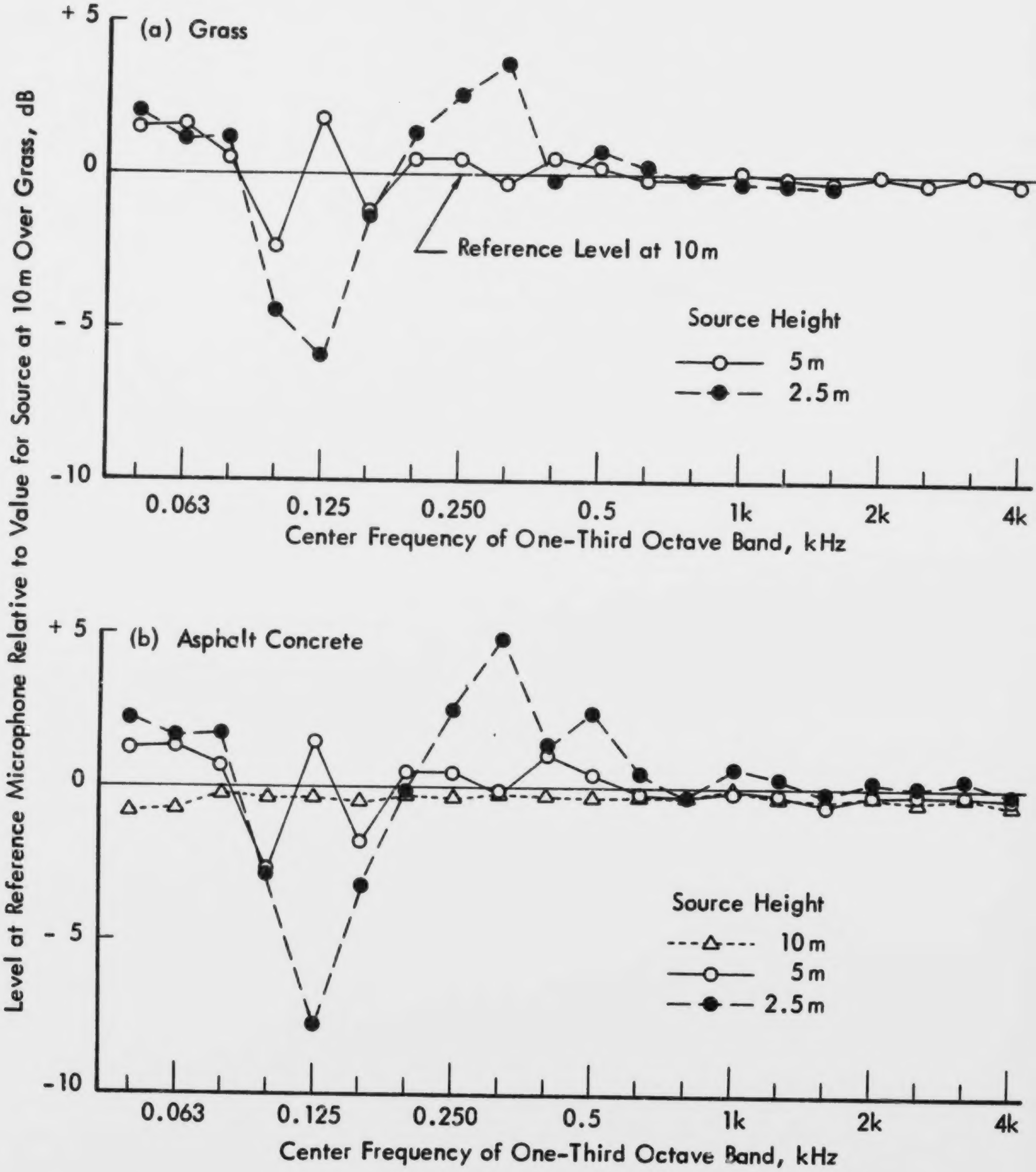

Figure 27. Variation of Reference Microphone Levels at 5 m from Source Relative to Value for Source at 10 m Over Grass (see Table 13).

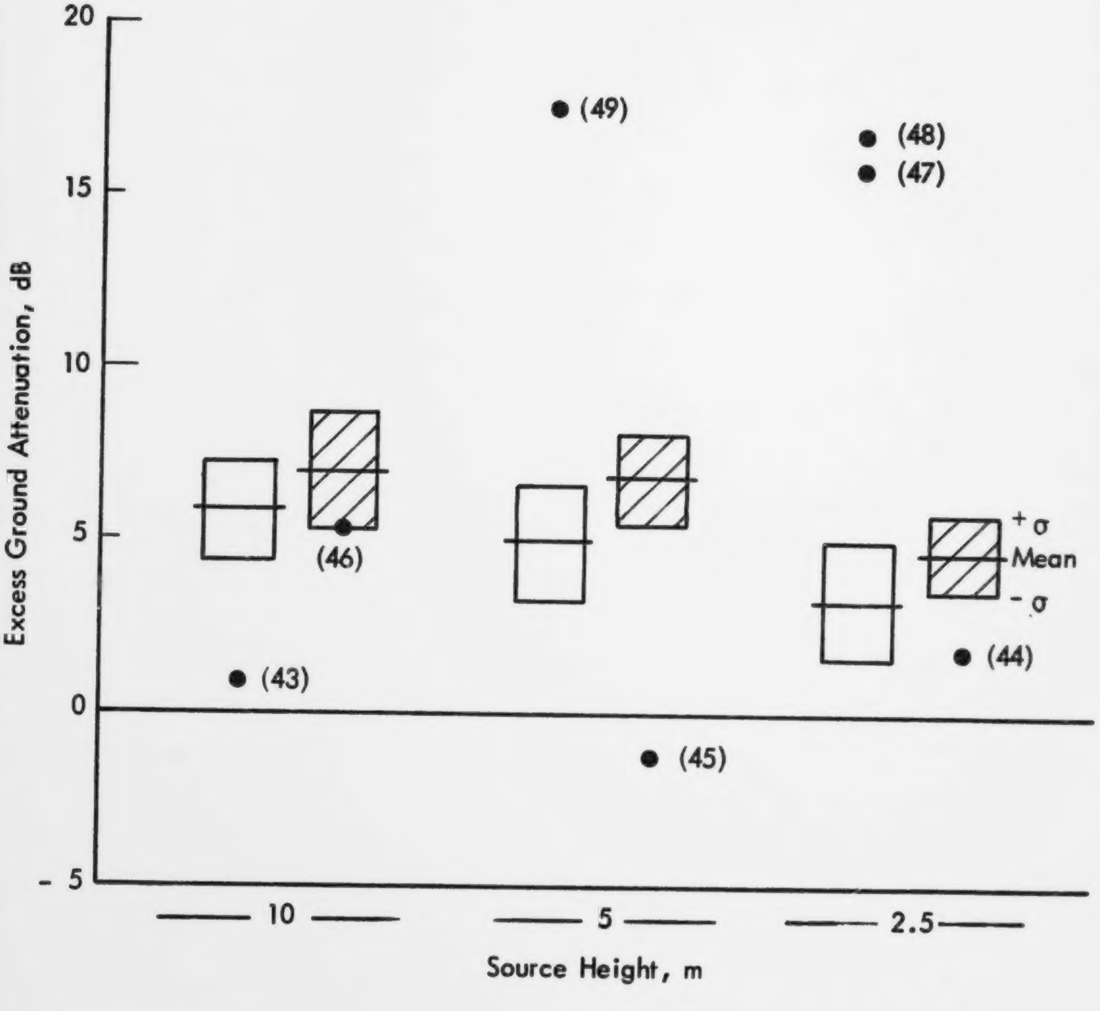

Figure 28. Mean and Standard Deviation of EGA Sample at Two Frequencies (500 and 2500 Hz) and Three Distances (112.5, 225, and 450 m) for 1.2 m Microphone Over Grass (Open Bars) and Asphalt Concrete (Hatched Bars) Excluding Runs 43 to 49 Compared with Corresponding EGA Sample Values from These Later Runs (● Data Points with Run No. Indicated).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
(b)	56.3	1.2
(c)	112.5	1.2
(d)	225	0
(e)	225	1.2
(f)	255	10
(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

——— Asphalt Concrete

- - - - Grass

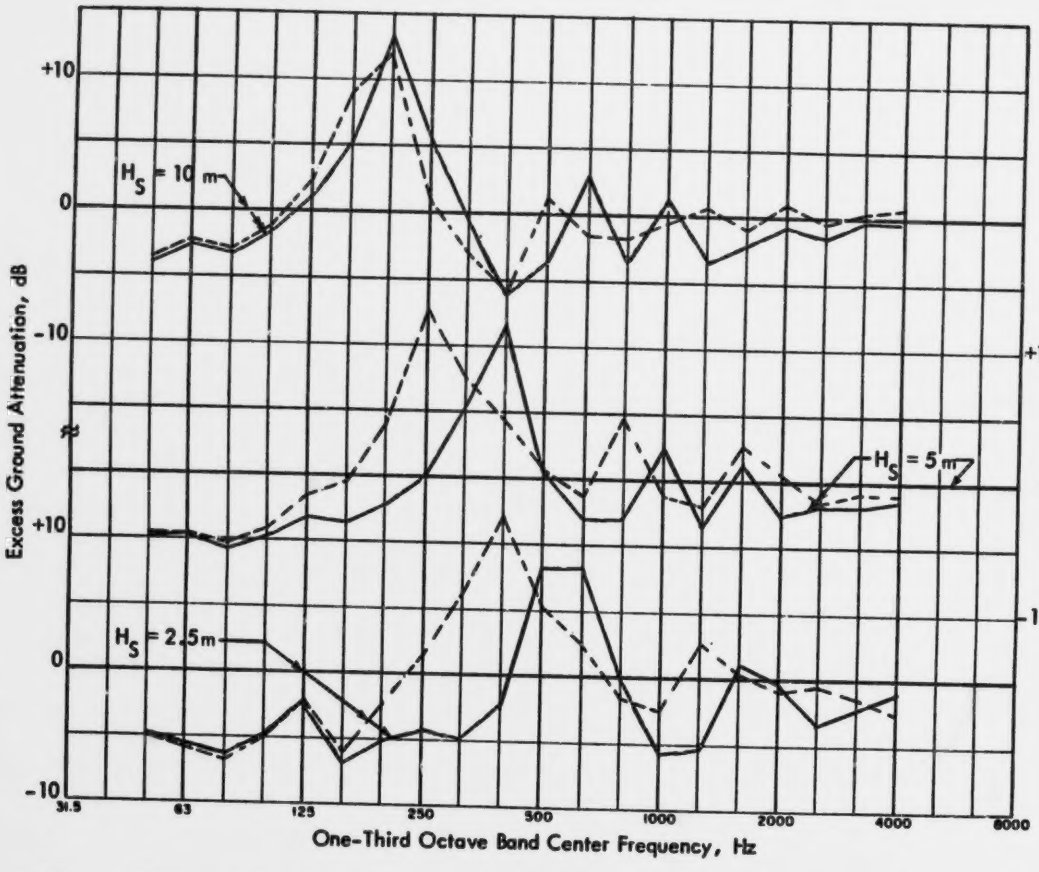

Figure 29. Comparison of Average EGA Values from Runs 9-42 for the Two Different Surfaces at Each Nominal Source Height (H_S) for all 10 Microphone Positions. (Distance (d) and Microphone Height (H_R) Specified in Index.)

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
(b)	56.3	1.2
(c)	112.5	1.2
(d)	225	0
(e)	225	1.2
(f)	255	10
(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

——— Asphalt Concrete
- - - - Grass

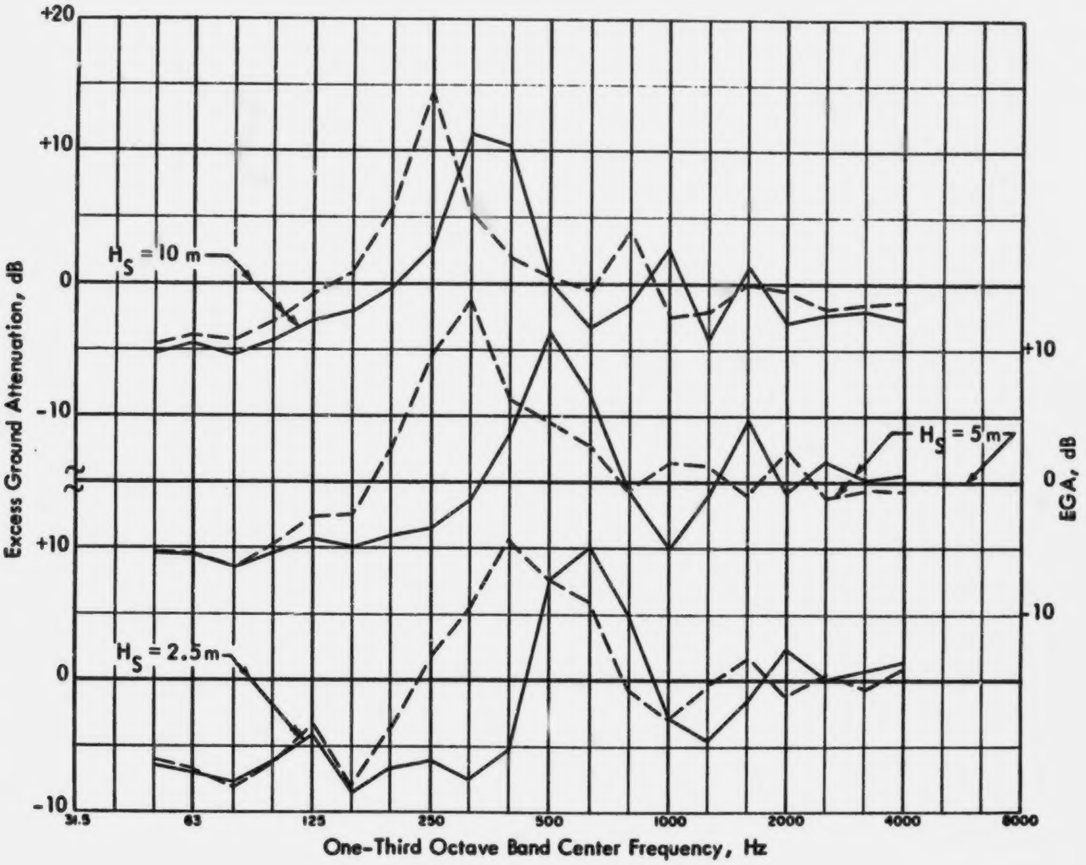

Figure 29 (Continued).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
(b)	56.3	1.2
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(d)	225	0
(e)	225	1.2
(f)	255	10
(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

——— Asphalt Concrete

- - - - Grass

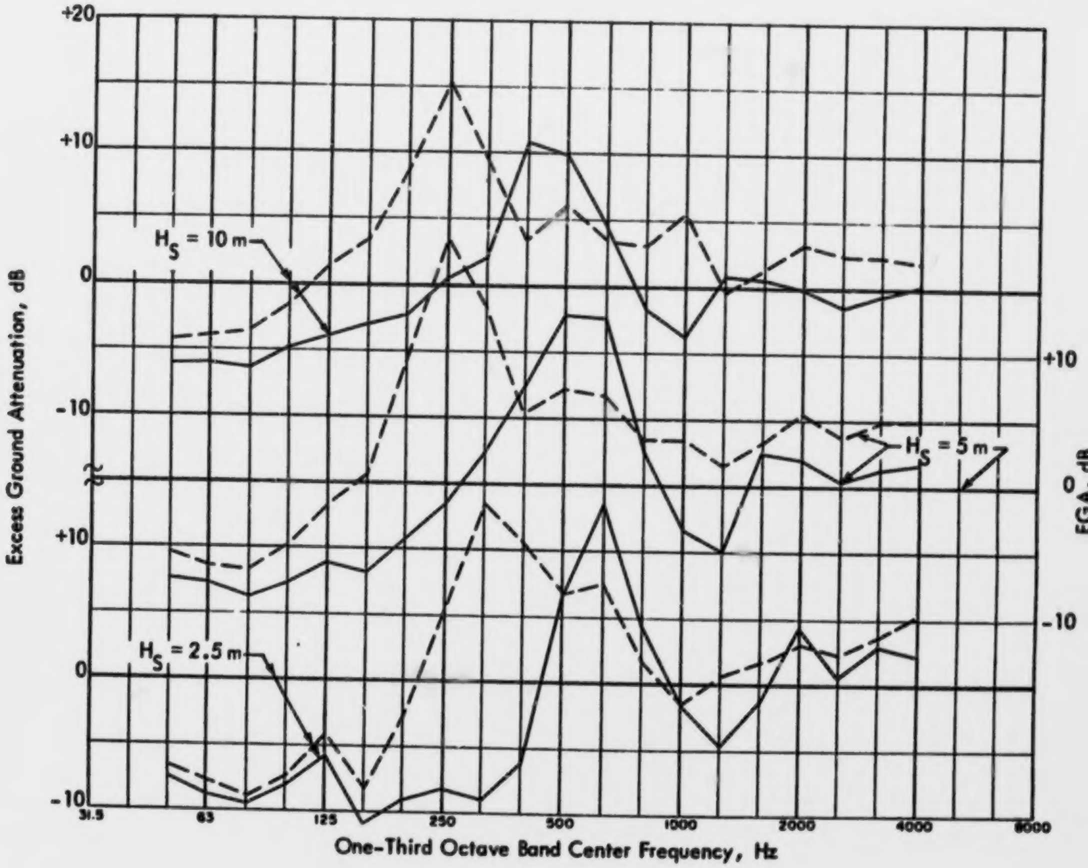

Figure 29 (Continued).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
(b)	56.3	1.2
(c)	112.5	1.2
(d)	225	0
(e)	225	1.2
(f)	255	10
(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

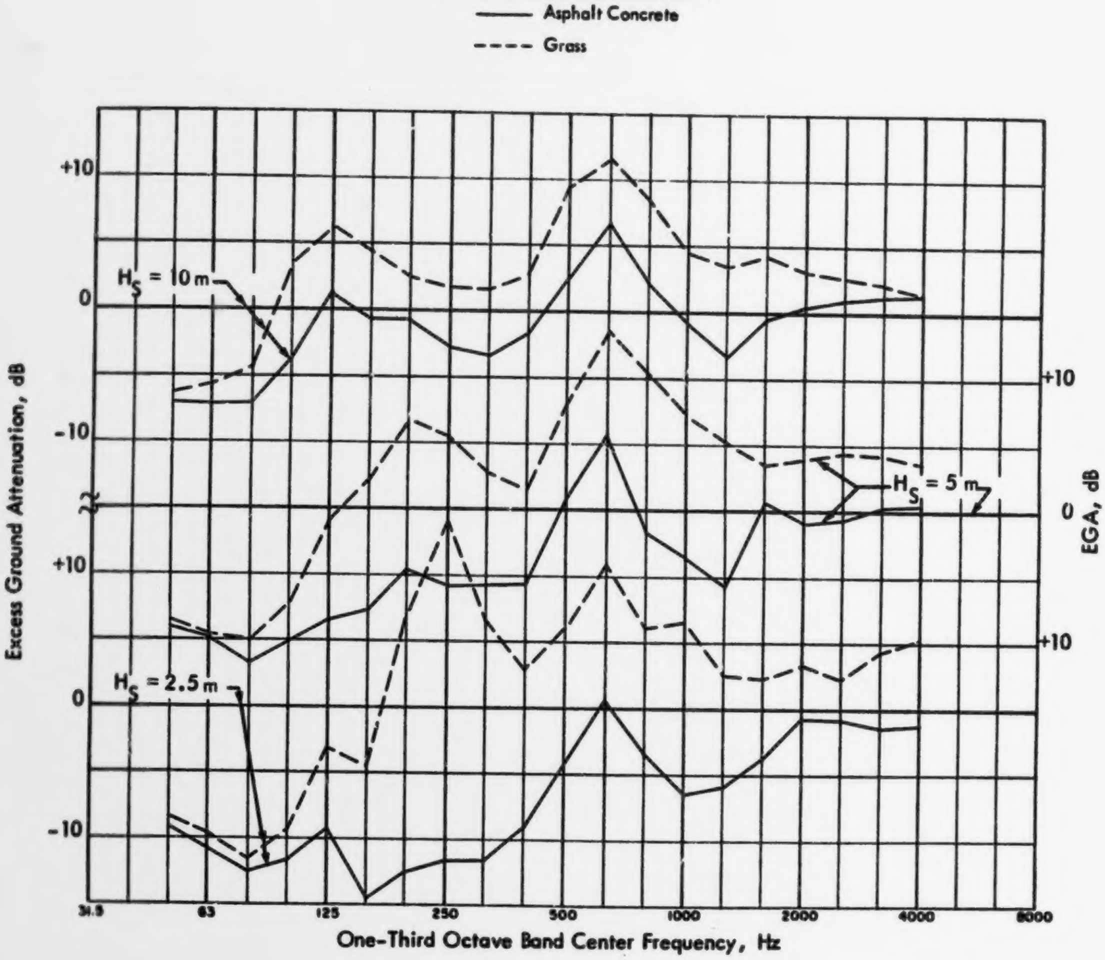

Figure 29 (Continued).

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Fig.	d, m	H_R, m
(a)	28.1	1.2
(b)	56.3	1.2
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(d)	225	0
(e)	225	1.2
(f)	255	10
(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

—— Asphalt Concrete
---- Grass

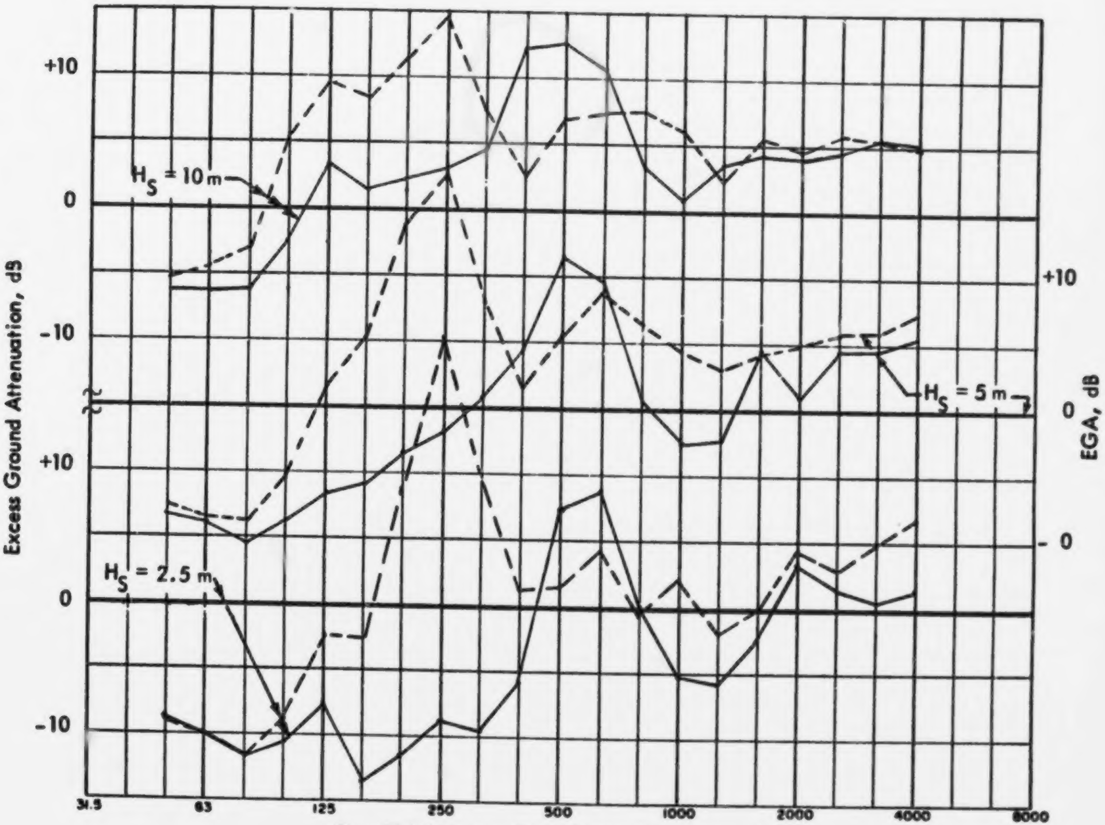

Figure 29 (Continued).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
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(j)	675	1.2

—— Asphalt Concrete

- - - - Grass

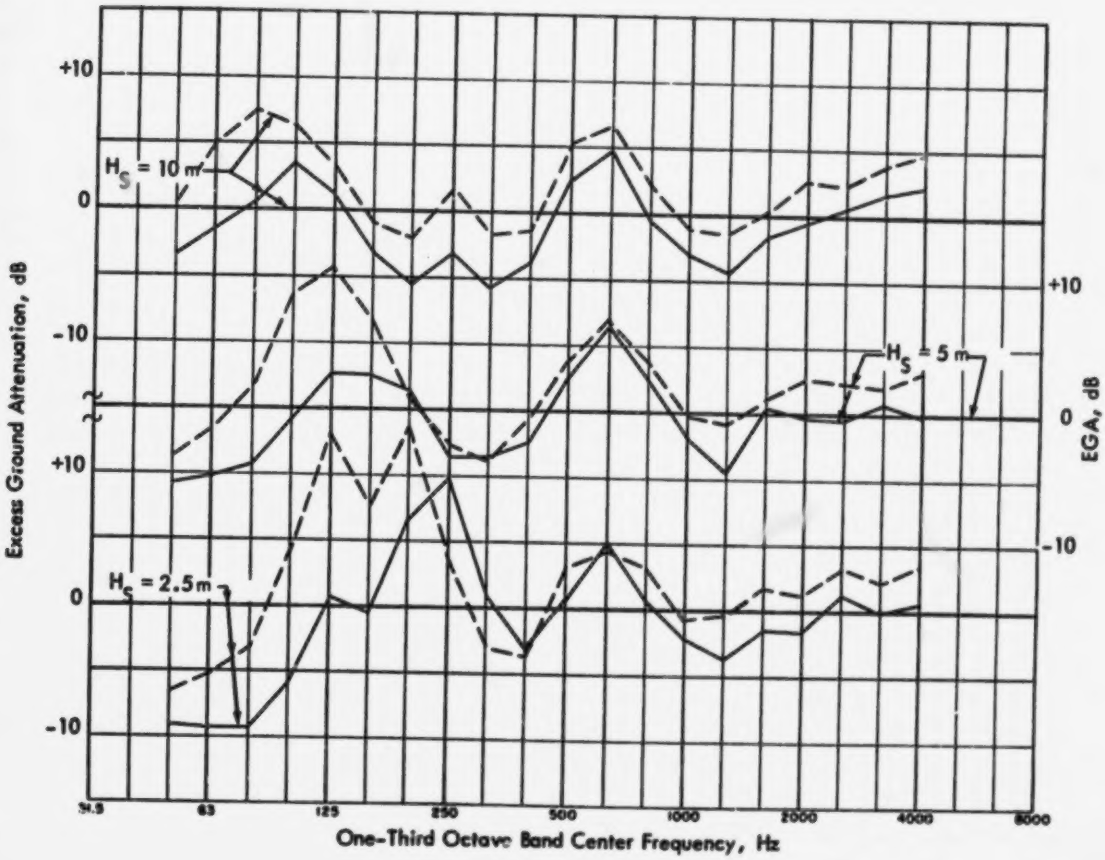

Figure 29 (Continued).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
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(d)	225	0
(e)	225	1.2
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(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

—— Asphalt Concrete

---- Grass

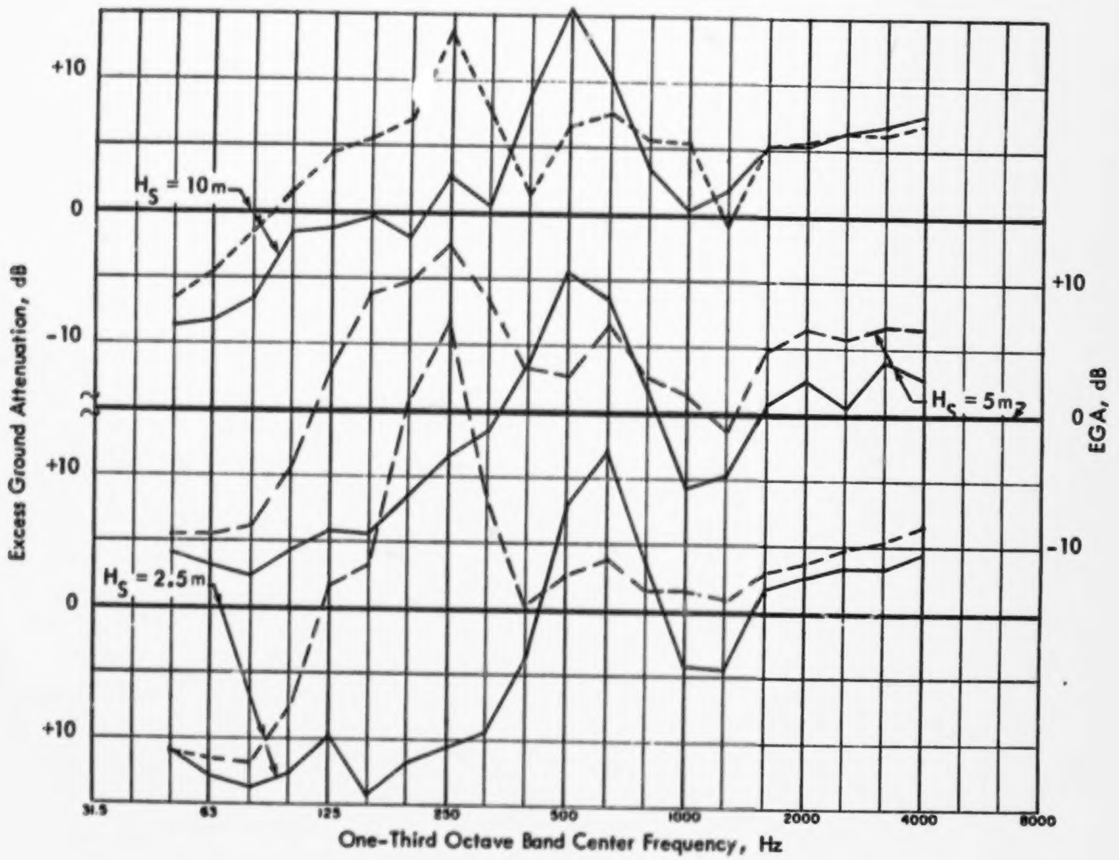

Figure 29 (Continued).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
(b)	56.3	1.2
(c)	112.5	1.2
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(f)	255	10
(g)	337.5	1.2
(h)	450	1.2
(i)	450	10
(j)	675	1.2

—— Asphalt Concrete

- - - - Grass

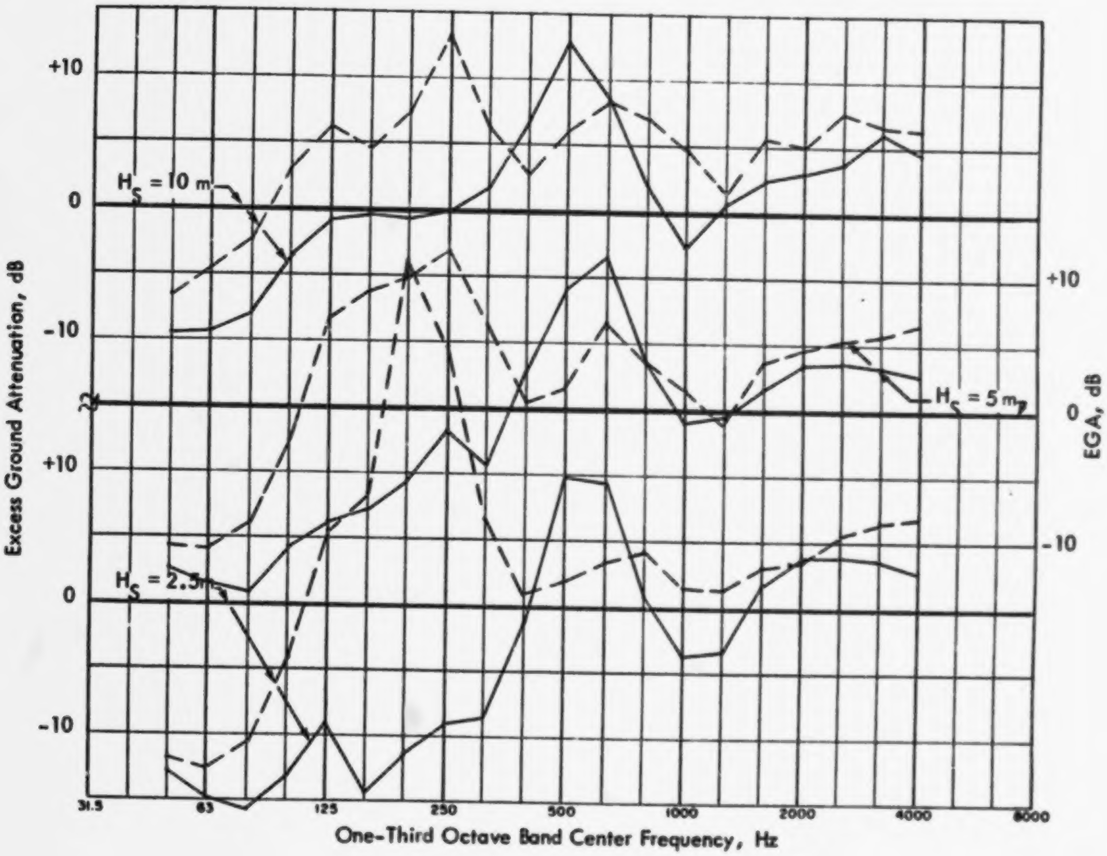

Figure 29 (Continued).

INDEX

Fig.	d, m	H_R, m
(a)	28.1	1.2
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(i)	450	10
(j)	675	1.2

——— Asphalt Concrete
- - - - Grass

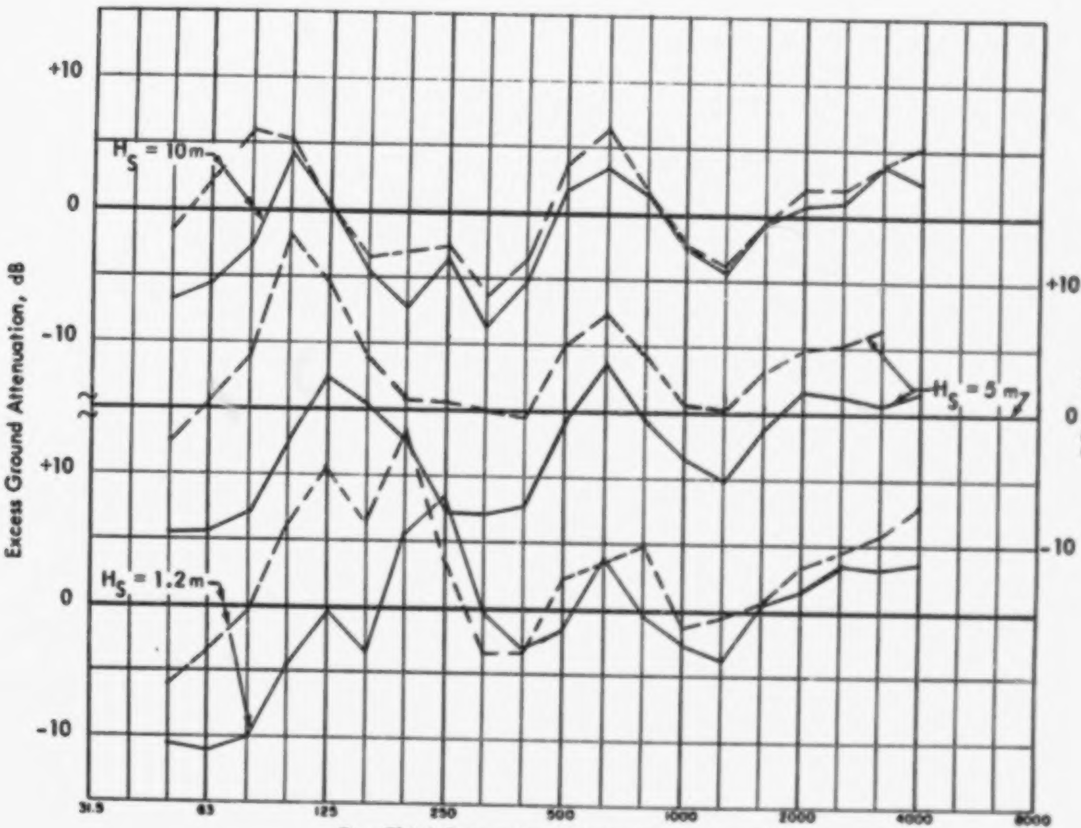

Figure 29 (Continued).

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Fig.	d, m	H_R, m
(a)	28.1	1.2
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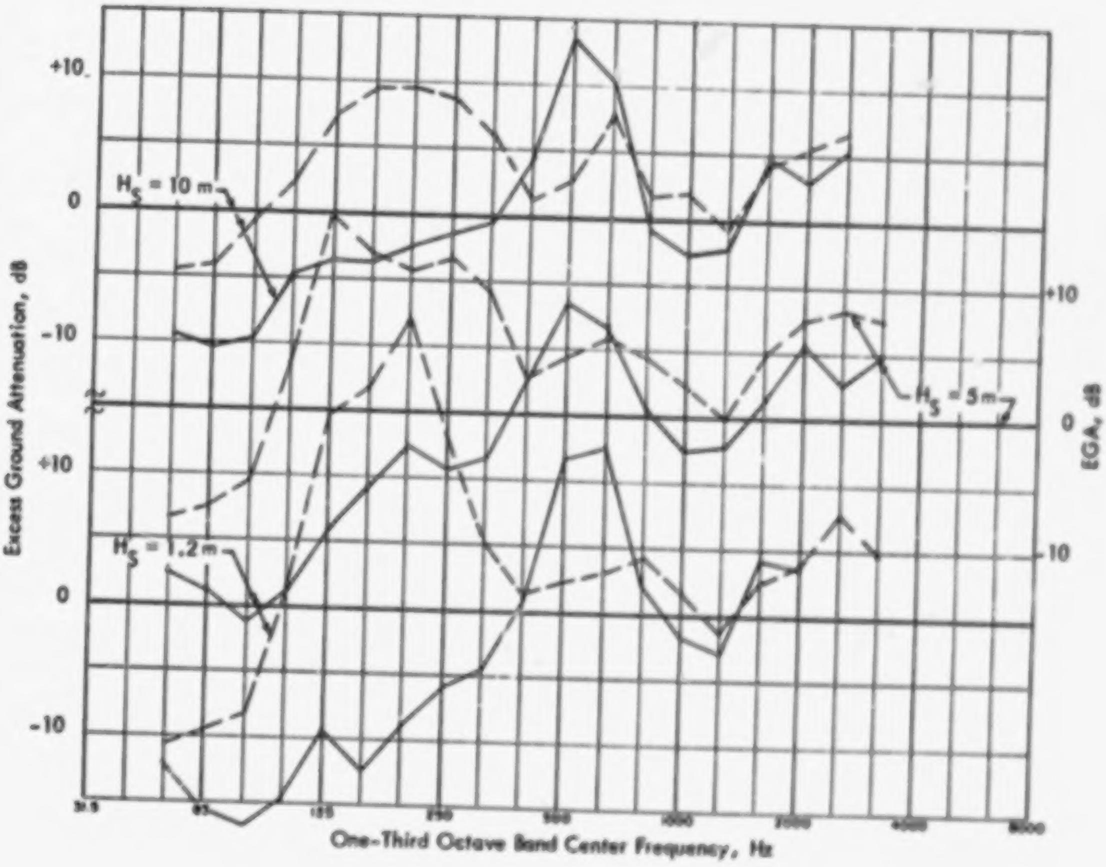
——— Asphalt Concrete

- - - - Grass



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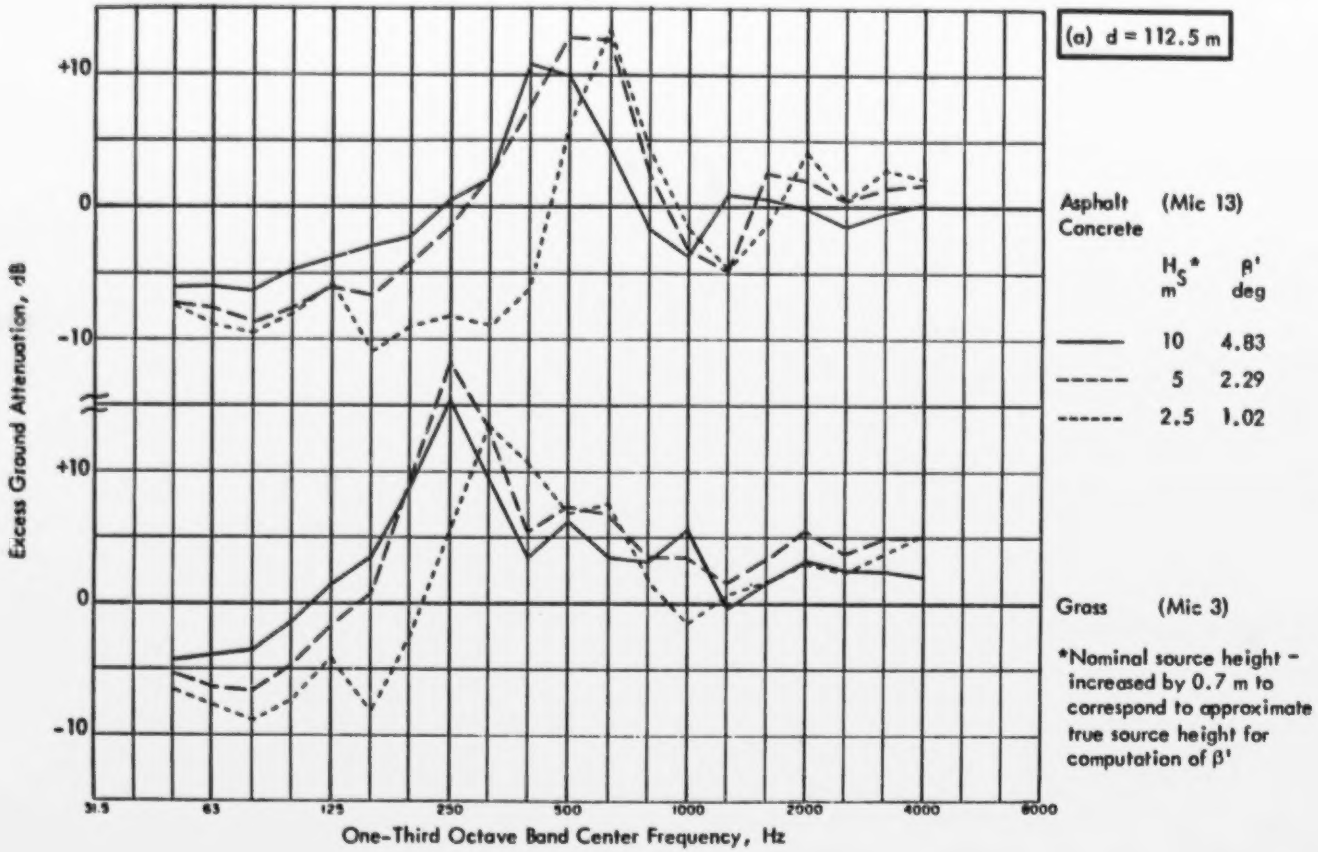
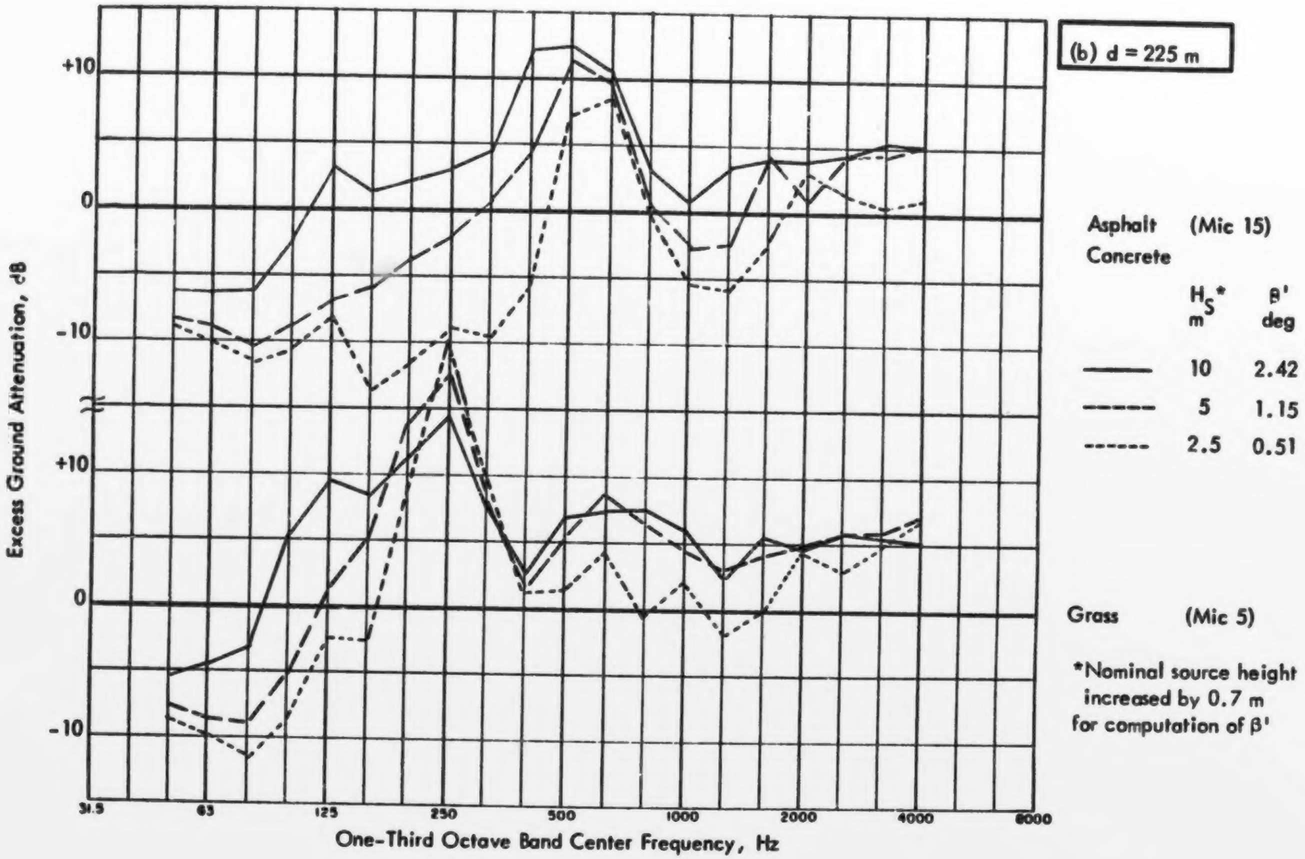


Figure 30. Comparison of Average EGA Values from Runs 9-42 for the Three Source Heights (H_S) at Four Microphone Positions, Microphone Height = 1.2 m.



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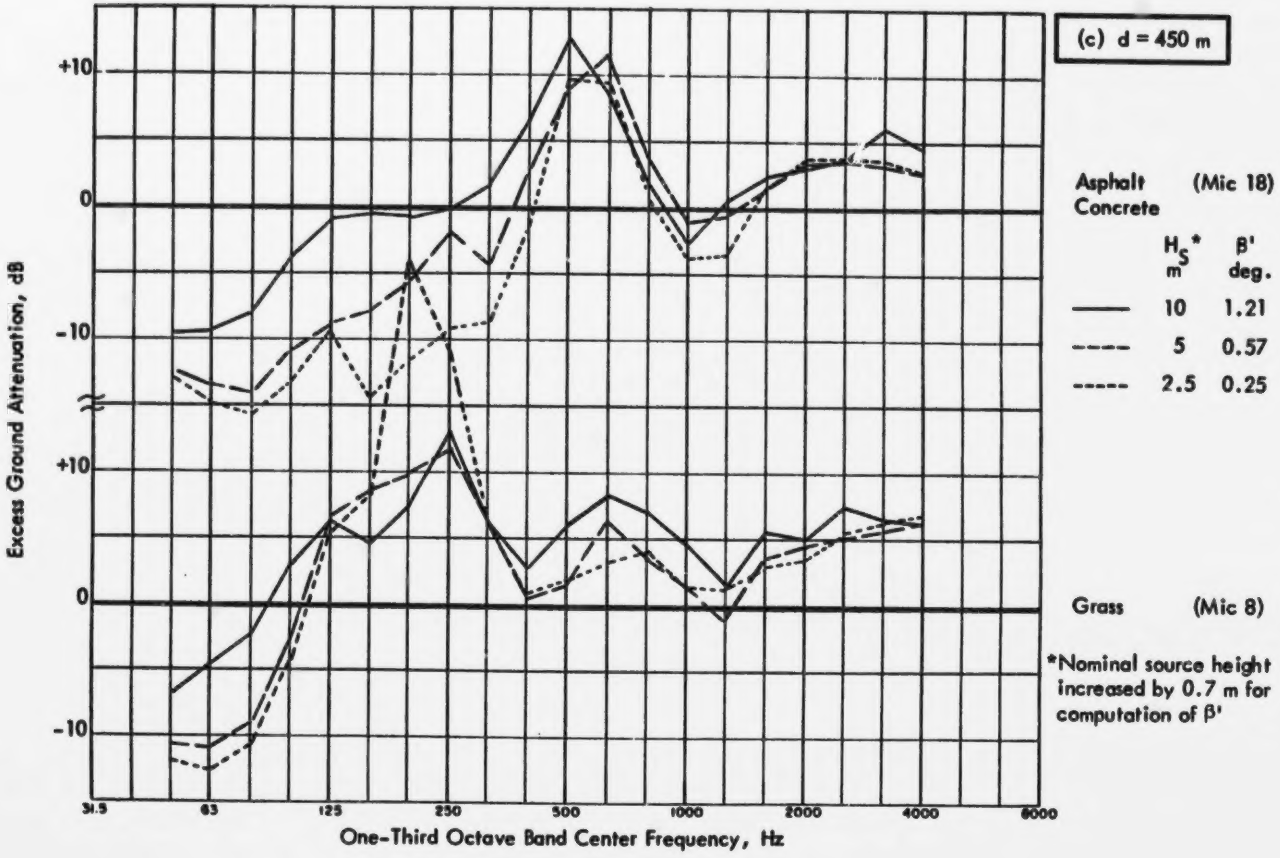
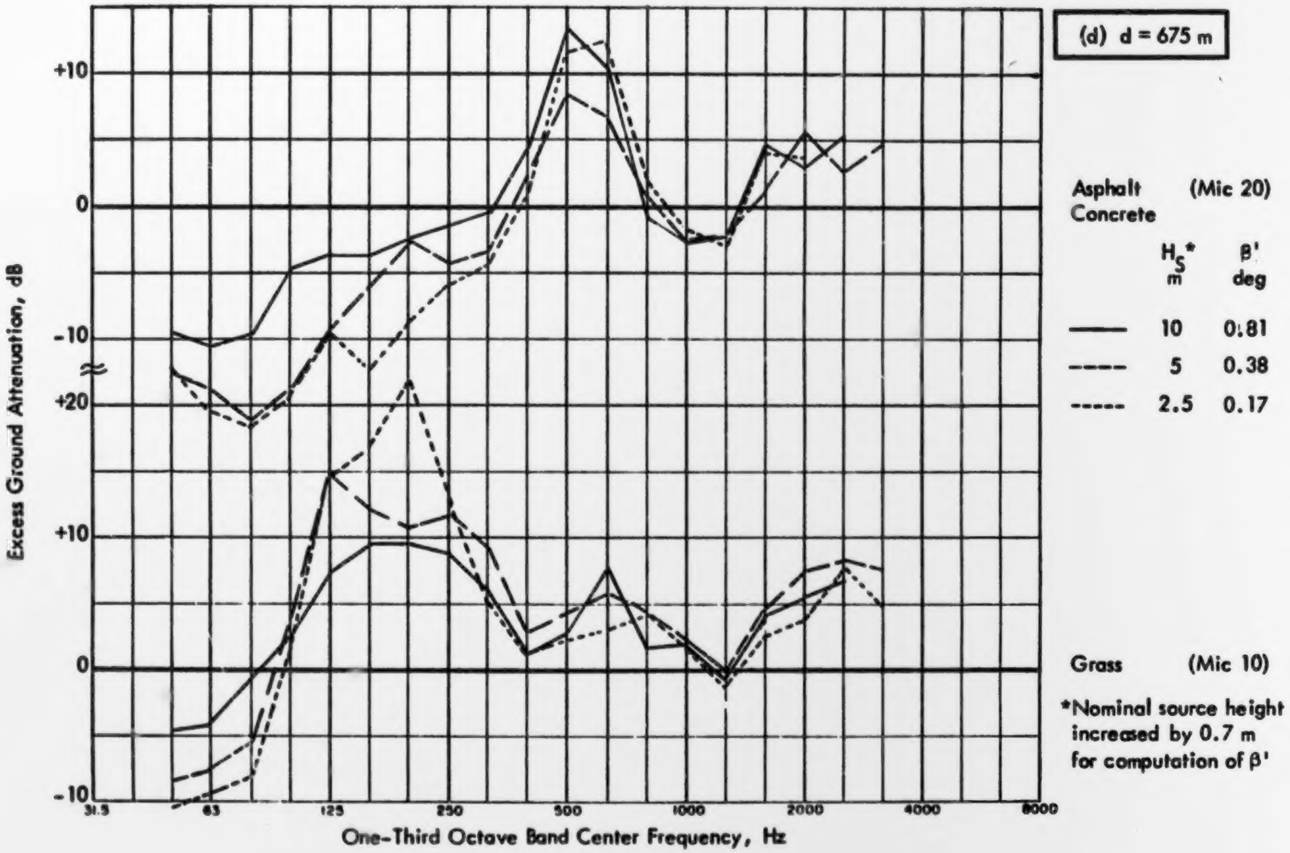


*Nominal source height increased by 0.7 m for computation of β'

Figure 30 (Continued).



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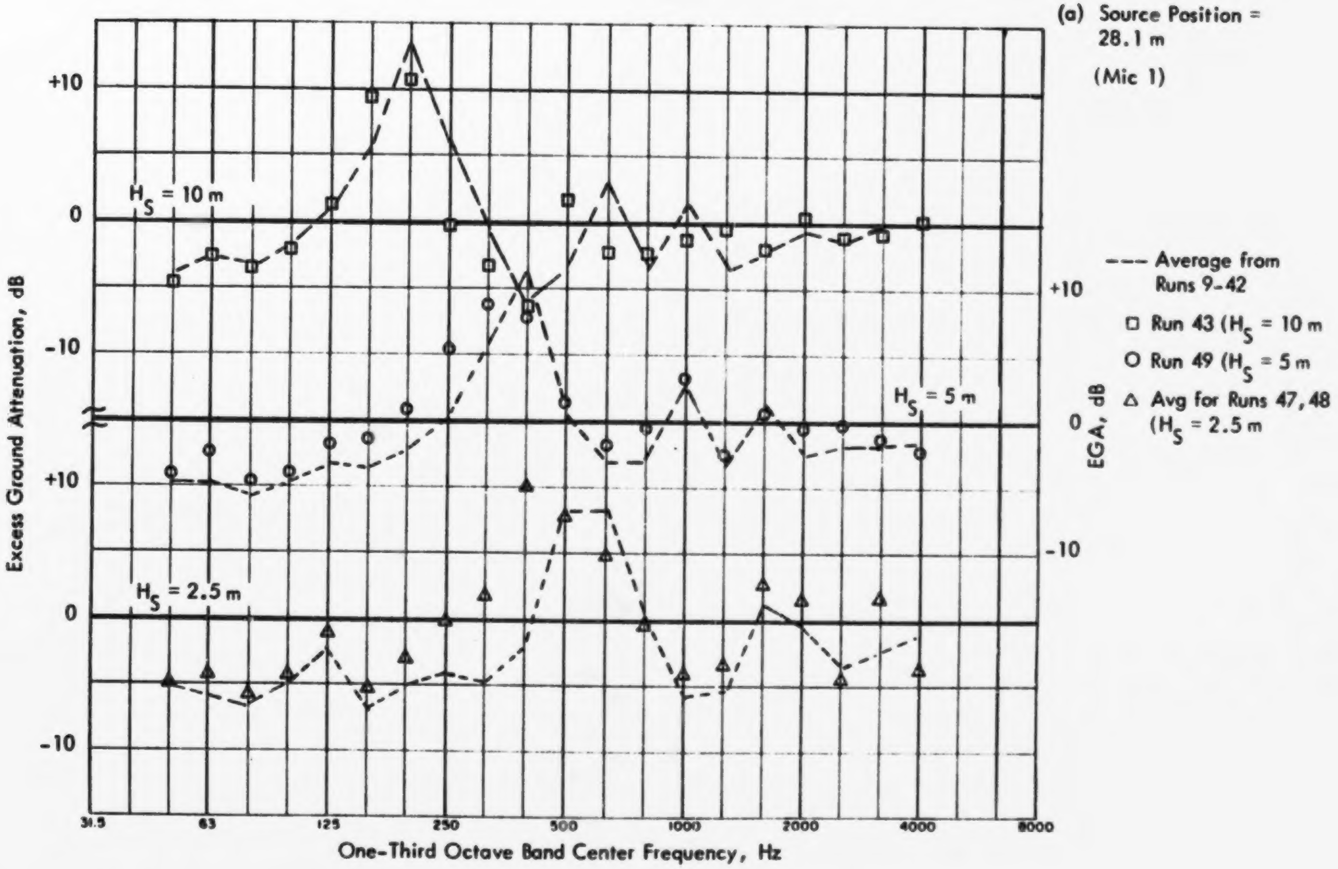

Figure 31. Data at Three Microphone Positions Over Grass from Runs 43, 47-49 when Vertical Gradient in Sound Velocity was Lowest Compared with Average from Earlier Runs 9-42 with Same Configuration.

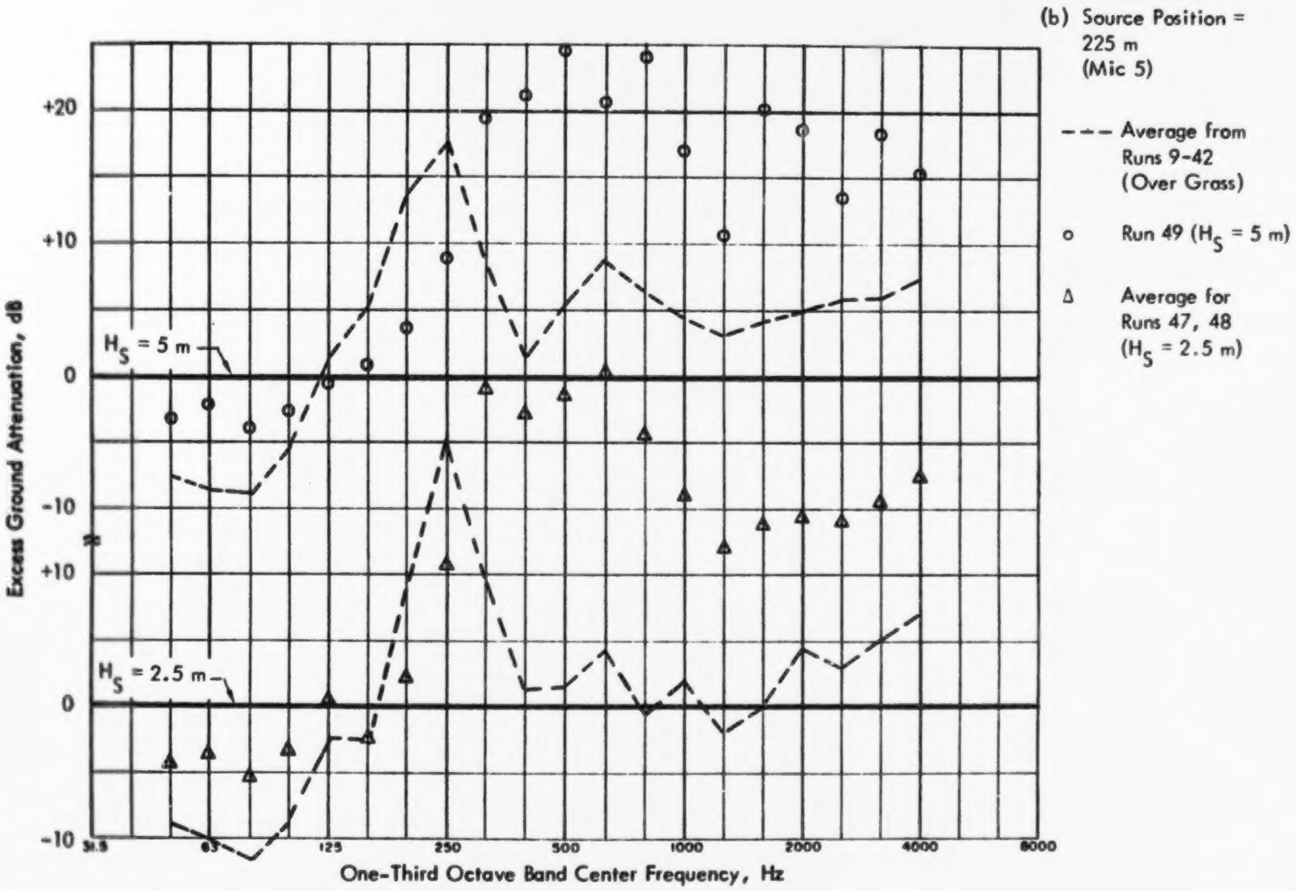

Figure 31. (Continued).

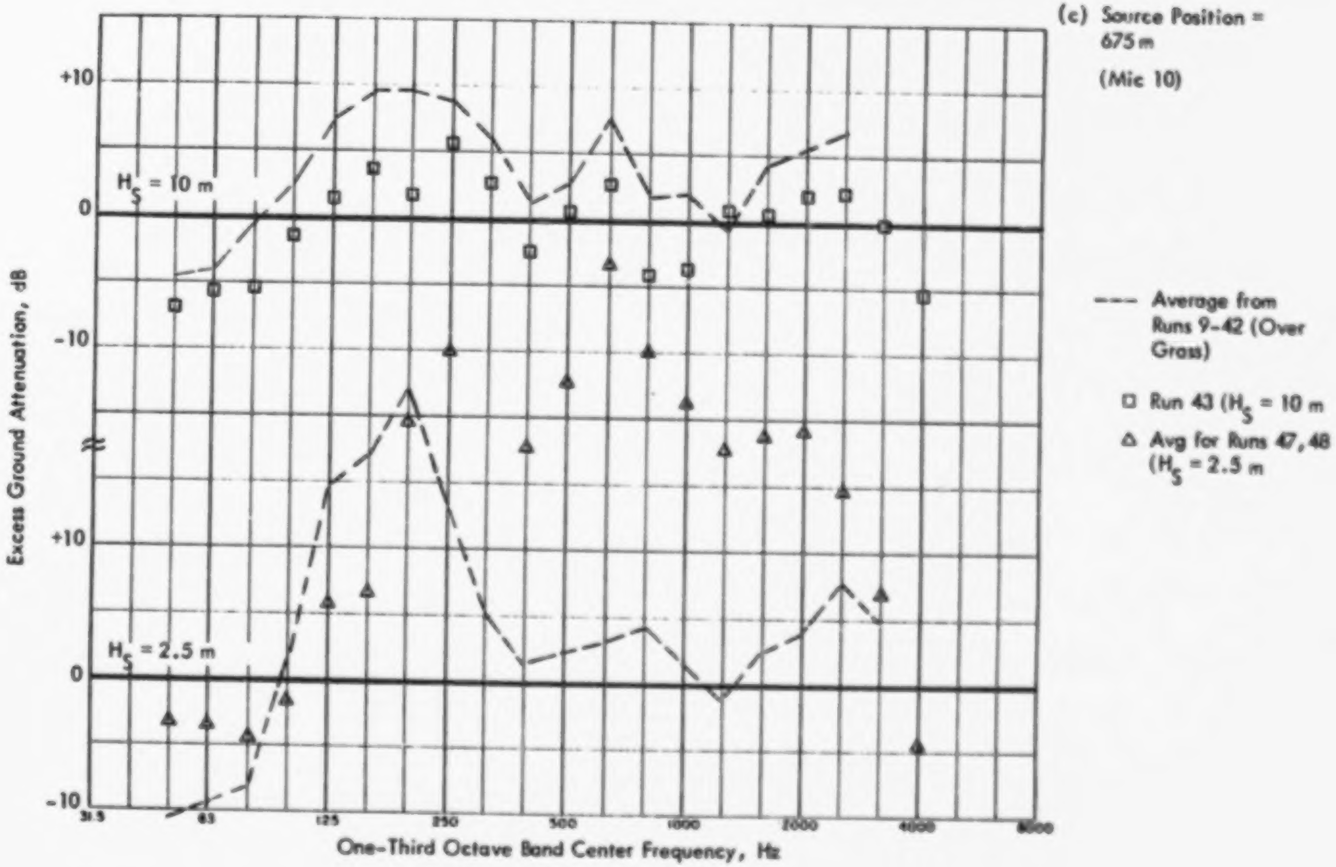

Figure 31. (Concluded).

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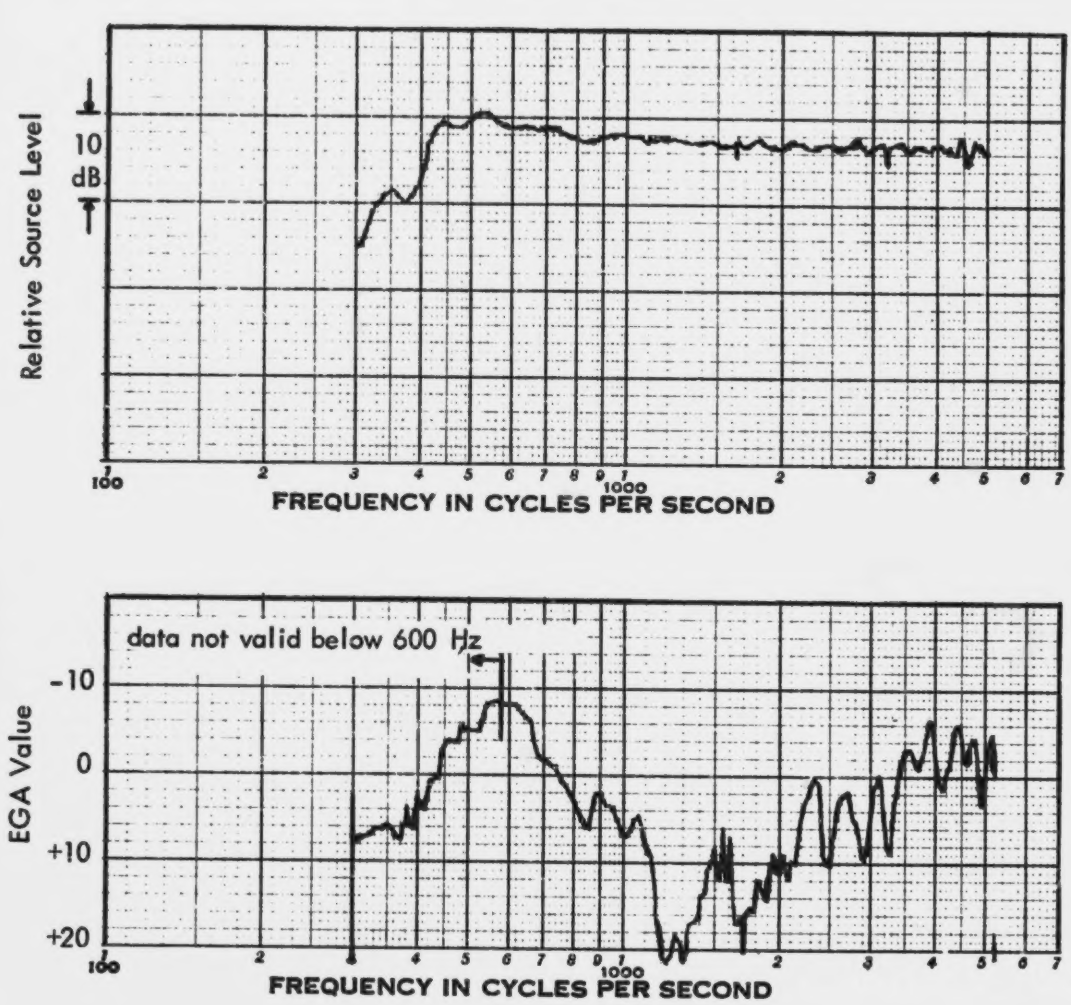

Figure 32. Plots of In Situ Measurements to Define Acoustic Ground Impedance at the Test site Between Microphone Positions 1 and 2 Over Grass. Source Height (H_S) = 0.15 m (0.5 ft), Receiver Height (H_R) = 0.3 m (1 ft), and distance (d) = 2.44 m (8 ft). Note that the EGA value increases for a decreasing ordinate - just the opposite of the data in Figures 29-31. The signal levels were adjusted in the field so that the received level was a direct plot of EGA values.

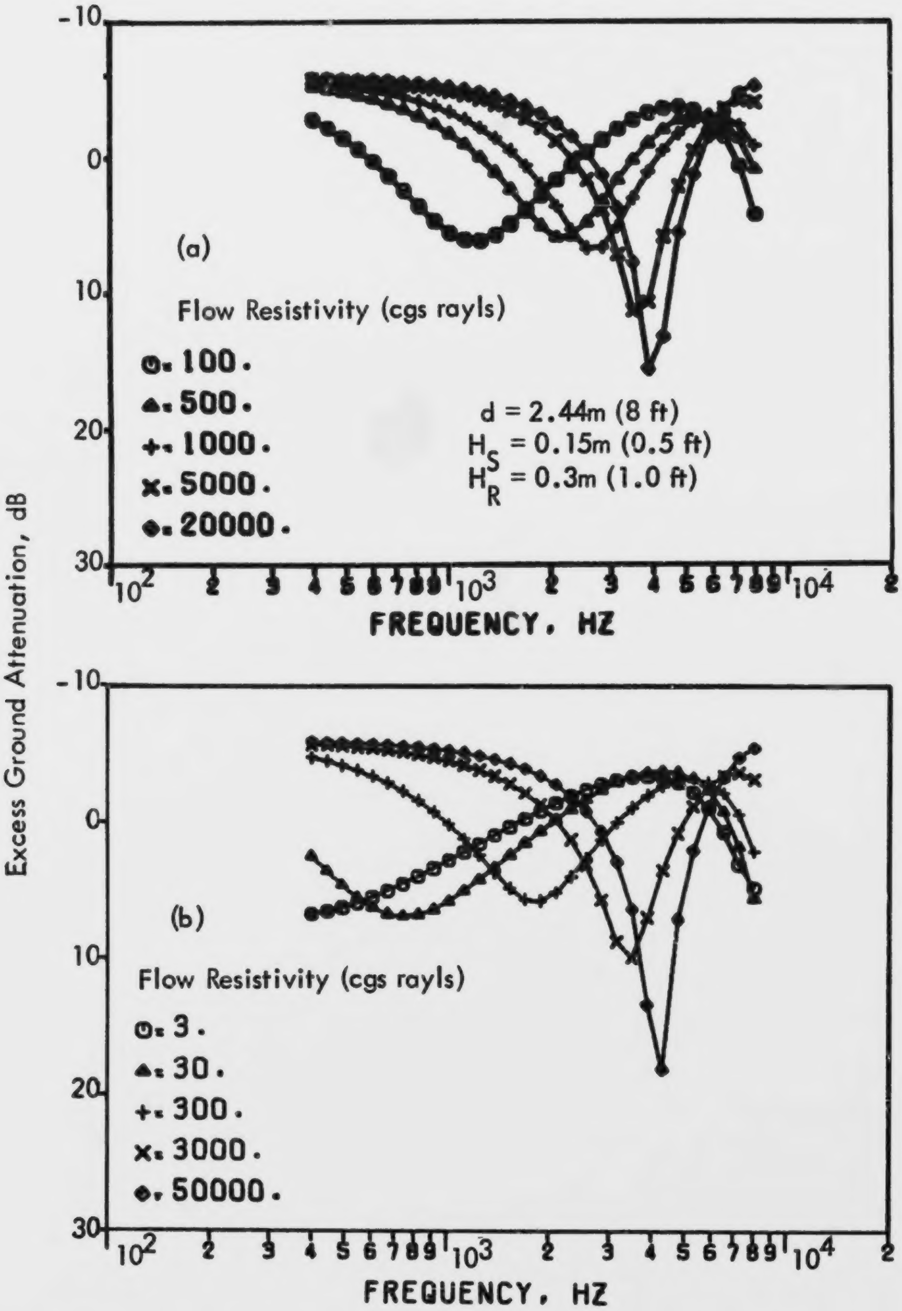

Figure 33. Predicted Excess Ground Attenuation for the Ground Impedance Measurement Configuration Employed at the Test Site for Selected Values of the Flow Resistivity (based on References 6 and 7).

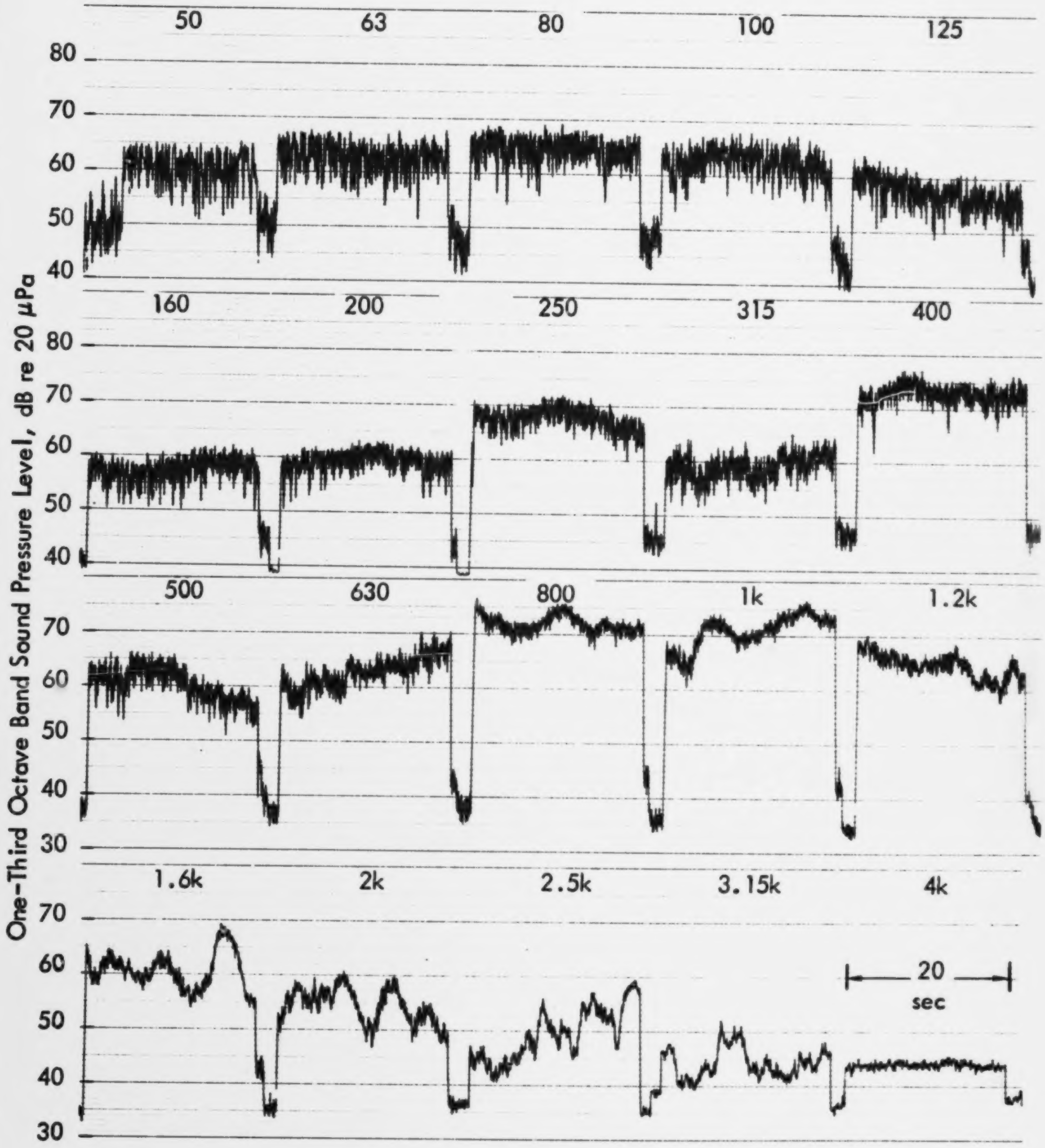

Figure 34. Time History of Each One-Third Octave Band Level as Received at Microphone 10 During Run 13, Source at 10 m Over Grass, Distance = 675 m, Microphone Height = 1.2 m.

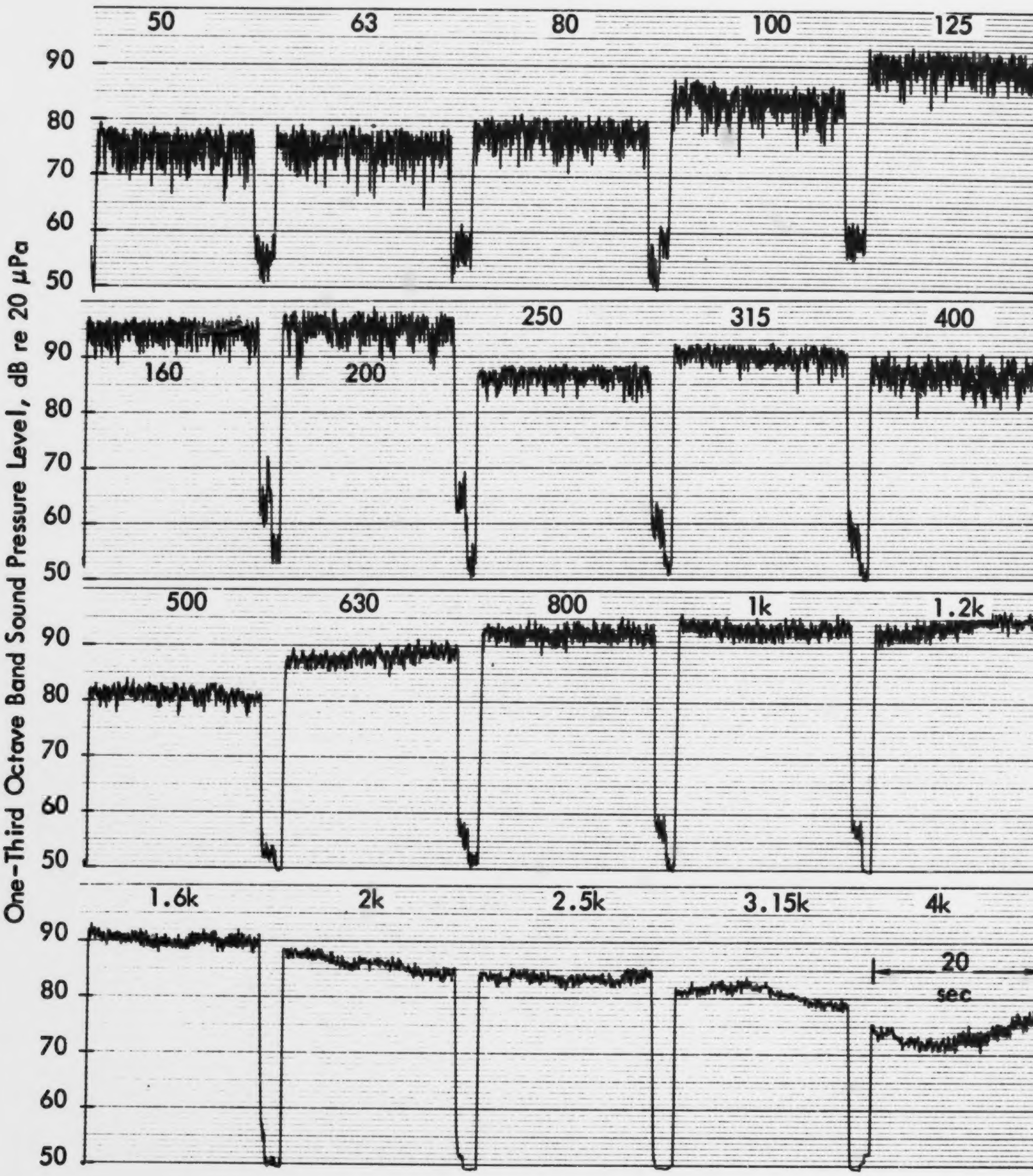

Figure 35. Time History pf Each One-Third Octave Band Level as Received at Microphone 16 During Run 35, Source at 10 m Over Grass, Distance = 225 m, Microphone Height = 10 m.

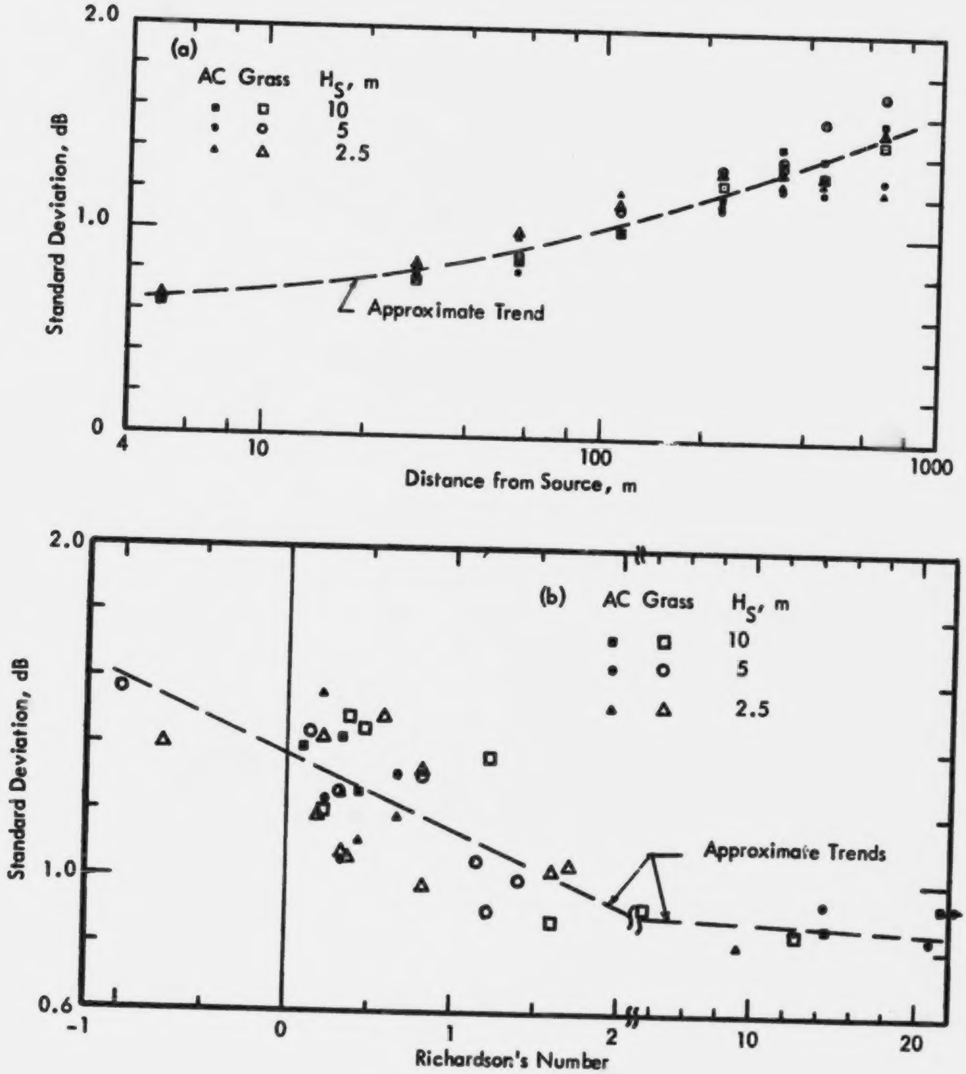

Figure 36. Approximate Trends in Fluctuation Level, in dB (a) As a Function of Distance, Averaged over Runs and over Frequency, and (b) As a Function of Richardson's Number, Averaged over Distance and over Frequency (From Table 16).

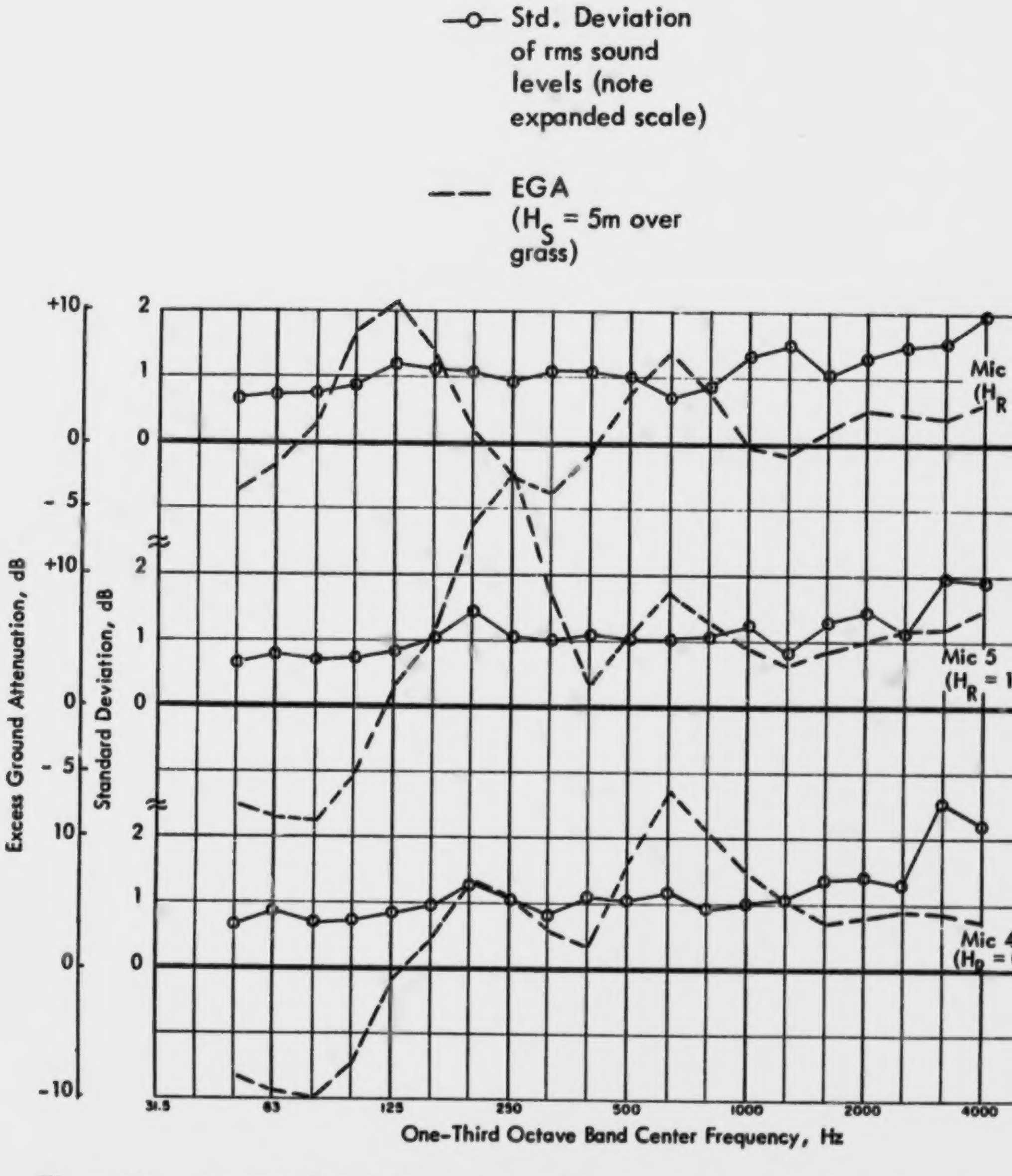

Figure 37. Average Standard Deviation (Fluctuation Level) of rms Sound Lev During 15-Second Test Period for Each Frequency Band at Mic phone Positions 4, 5, and 6 at 225 m from Source at 5 m over Gr (from Table 17). Values Also Compared to Average EGA Values These Positions (from Table 15(c)). Standard Deviation (Fluctuat Levels) Averaged over Runs 10, 20, 32, 36 and 42 for wh Richardson's Number was Between 0.2 and 2.

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APPENDIX A

Tables of Detailed Run Data

Table A-1

Index to Tables of Detailed Run Data

Table No.	Run No.	Surface	Source Height, m
A-2.1	9	Grass	10
A-2.2	13		
A-2.3	21		
A-2.4	25		
A-2.5	33		
A-2.6	35		
A.2-7	43		
A-3.1	10		5
A-3.2	14		
A-3.3	20		
A-3.4	26		
A-3.5	32		
A-3.6	36		
A-3.7	42		
A-3.8	49		
A-4.1	11		2.5
A-4.2	15		
A-4.3	19		
A-4.4	27		
A-4.5	31		
A-4.6	34		
A-4.7	37		
A-4.8	41		
A-4.9	47		
A-4.10	48		
A-5.1	18	Asphalt Concrete	10
A-5.2	24		
A-5.3	30		
A-5.4	40		
A-5.5	46		
A-6.1	17		5
A-6.2	23		
A-6.3	29		
A-6.4	39		
A-6.5	45		
A-7.1	12		2.5
A-7.2	16		
A-7.3	22		
A-7.4	28		
A-7.5	38		
A-7.6	44		

Table A-2.1

Results for Measurements Over Grass, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 9

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.6	80.7	73.8	70.8	70.0	63.4	67.5	64.5	59.9	57.8	97.7
0.063	89.0	84.7	77.9	74.6	73.5	62.3	69.5	66.6	61.0	61.3	102.3
0.080	93.6	89.3	81.6	76.8	75.7	63.9	69.9	68.5	60.6	64.4	106.6
0.100	94.2	89.9	81.3	68.3	66.9	70.5	69.7	66.0	67.1	63.8	109.0
0.125	92.4	89.5	79.7	69.1	66.1	76.0	68.2	65.6	74.7	62.4	110.8
0.160	88.1	91.1	81.7	77.6	74.4	81.7	70.0	68.8	80.9	68.0	113.4
0.200	86.8	86.4	77.5	78.7	69.7	93.1	69.0	68.0	79.7	67.1	114.0
0.250	95.4	75.4	67.4	77.3	64.0	76.5	61.0	61.5	71.4	62.7	112.0
0.315	93.9	80.8	71.6	72.8	66.9	73.3	62.1	62.7	76.0	64.3	107.0
0.400	97.3	84.3	77.3	70.5	71.7	78.2	72.5	67.5	71.3	68.9	107.4
0.500	93.1	89.1	77.5	67.9	69.8	72.4	68.1	64.3	71.4	66.7	110.9
0.630	102.5	96.1	84.6	67.7	72.4	76.1	69.9	69.2	72.5	69.0	116.7
0.800	102.4	89.1	84.4	73.5	75.3	80.7	74.0	64.2	77.9	72.0	116.4
1.000	99.7	97.1	80.8	74.8	73.7	92.4	70.8	70.2	79.2	65.5	114.7
1.250	96.6	92.9	85.1	75.8	77.0	81.1	76.5	70.5	79.4	69.7	113.2
1.600	97.9	92.1	83.6	73.0	71.9	78.5	69.3	60.8	73.6	61.7	112.7
2.000	95.4	90.3	79.9	73.0	70.5	73.4	64.0	62.2	66.2	59.7	111.9
2.500	95.7	90.6	77.7	72.6	68.8	72.7	62.1	57.8	64.9	54.8	111.8
3.150	94.5	89.8	77.1	70.5	66.0	69.5	60.7	52.4	56.8	53.4	110.8
4.000	92.8	87.0	74.8	64.6	62.7	63.4	56.5	53.6	53.7	57.3	109.8
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	10.0

(b) Excess Attenuation, dB

RUN 9

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.3	-4.1	-3.2	-6.1	-5.3	1.2	-6.4	-5.9	-1.4	-2.7	0.0
0.063	-1.6	-3.0	-2.2	-4.9	-3.8	7.0	-3.4	-2.9	2.7	-1.2	0.0
0.080	-2.4	-3.8	-2.1	-3.3	-2.2	9.6	0.0	-1.1	6.9	-0.5	0.0
0.100	-0.6	-2.1	0.6	7.6	9.0	5.4	2.6	3.8	2.7	2.4	0.0
0.125	3.0	0.1	4.0	8.6	11.6	1.7	5.9	6.0	-3.1	5.6	0.0
0.160	9.9	1.1	4.6	2.6	5.8	-1.5	6.6	5.3	-6.7	2.4	0.0
0.200	11.8	6.4	9.4	2.1	11.0	-2.3	8.2	6.6	-5.1	3.8	0.0
0.250	1.2	15.4	17.4	1.4	14.7	2.2	14.1	11.0	1.1	6.1	0.0
0.315	-2.3	5.0	8.3	0.9	6.8	0.4	8.0	4.7	-8.6	-0.7	0.0
0.400	-5.4	1.9	2.9	3.5	2.3	-4.2	-2.1	0.2	-3.6	-5.1	0.0
0.500	2.3	0.6	6.2	9.6	7.7	5.1	5.6	6.7	-0.3	0.5	0.0
0.630	-1.3	-0.6	4.8	15.5	10.8	7.1	9.5	7.5	4.2	3.6	0.0
0.800	-1.5	6.0	4.6	9.2	7.5	2.1	4.9	12.0	-1.8	0.0	0.0
1.000	-0.5	-3.7	6.5	6.1	7.2	-1.5	6.2	3.9	-4.1	4.2	0.0
1.250	1.1	-1.1	0.5	3.3	2.1	-2.0	-1.5	1.5	-7.4	-2.3	0.0
1.600	-0.8	-0.9	1.3	5.1	6.2	-0.4	4.6	9.8	-3.0	3.8	0.0
2.000	0.8	-0.1	3.9	3.6	6.2	3.3	8.0	6.2	2.2	3.0	0.0
2.500	0.3	-0.7	5.4	2.9	6.7	2.8	8.2	8.3	1.2	4.4	0.0
3.150	0.3	-1.3	4.2	2.3	6.8	3.3	6.0	9.2	4.3	-0.3	0.0
4.000	0.7	-0.1	4.2	4.5	6.5	5.7	5.2	1.7	1.6	-13.3	0.0

Table A-2.2

Results for Measurements Over Grass, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 13

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	95.5	90.7	74.2	70.2	69.5	65.8	67.1	64.9	60.9	60.5	97.4
0.063	93.7	94.6	78.9	75.0	74.0	67.3	71.0	69.6	62.1	62.6	101.6
0.080	93.5	89.5	82.8	79.4	77.2	66.9	71.9	68.6	62.6	64.5	106.2
0.100	94.4	90.7	83.5	75.6	73.9	68.9	67.2	65.8	59.4	63.1	108.9
0.125	92.7	90.1	81.3	65.3	61.4	75.2	66.8	61.7	67.8	55.9	110.1
0.160	88.9	90.9	82.1	71.4	67.6	81.3	68.2	65.1	75.3	56.9	113.0
0.200	94.9	96.8	78.4	75.2	67.1	83.8	67.2	64.3	78.8	53.7	113.6
0.250	94.1	74.3	68.6	72.6	60.1	82.1	61.7	60.0	77.2	57.2	111.0
0.315	93.5	79.8	68.6	70.9	66.3	71.4	60.6	55.5	69.3	45.1	106.1
0.400	97.2	94.2	75.6	73.0	73.9	74.1	67.3	57.7	73.0	62.7	107.2
0.500	93.2	88.2	76.3	67.3	71.2	70.7	66.0	63.0	65.9	60.0	110.1
0.630	101.9	95.9	96.3	70.7	76.7	79.0	73.2	65.9	69.0	62.2	116.3
0.800	102.5	89.7	83.4	71.3	70.5	79.3	72.6	69.4	75.9	71.5	116.0
1.000	93.9	96.1	90.3	75.4	73.9	82.9	69.6	64.4	75.1	70.4	114.3
1.250	95.8	93.4	85.3	75.8	76.4	73.6	74.4	67.4	76.2	64.8	112.6
1.600	97.3	92.0	81.4	72.9	71.4	77.1	69.2	64.1	69.4	60.1	111.9
2.000	94.2	90.1	79.9	73.8	70.0	74.6	64.7	63.6	64.5	54.5	111.4
2.500	95.0	90.3	79.2	71.2	67.2	73.9	63.3	60.4	59.0	45.6	111.0
3.150	93.5	89.1	78.3	70.3	65.6	69.2	55.2	53.7	57.1	*******	110.2
4.000	92.1	87.6	77.0	66.4	61.2	65.9	53.7	47.8	49.1	*******	109.1
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**10.0**

(b) Excess Attenuation, dB

RUN 13

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.5	-4.4	-3.9	-5.9	-5.2	-1.5	-6.3	-6.6	-2.6	-5.9	0.0
0.063	-2.5	-4.1	-4.3	-6.5	-5.5	1.2	-6.0	-6.1	0.4	-3.7	0.0
0.080	-2.7	-4.4	-3.7	-5.3	-4.1	6.3	-2.3	-1.5	4.4	-1.0	0.0
0.100	-1.0	-3.1	-1.8	0.1	1.8	6.8	4.9	3.3	10.2	2.9	0.0
0.125	2.0	-1.2	1.7	11.6	15.5	1.7	6.6	9.1	3.0	11.3	0.0
0.160	9.9	0.9	3.8	8.4	12.2	-1.5	9.0	8.6	-1.7	13.0	0.0
0.200	13.3	5.6	8.0	5.1	13.2	-3.5	9.5	9.8	-4.7	11.7	0.0
0.250	1.5	15.5	15.2	5.1	17.6	-4.4	12.3	11.4	-5.3	10.4	0.0
0.315	-2.9	5.1	10.3	1.8	6.4	1.3	9.4	10.9	-1.9	16.4	0.0
0.400	-5.5	1.8	4.3	0.7	-0.2	-0.4	2.7	9.6	-5.7	0.6	0.0
0.500	1.4	0.6	6.5	9.2	5.3	5.8	6.9	7.0	4.1	6.0	0.0
0.630	-1.1	-0.9	2.6	11.9	5.9	3.6	5.6	10.1	7.0	9.7	0.0
0.800	-2.0	5.0	5.2	10.9	11.7	2.9	5.7	6.0	-0.5	-0.3	0.0
1.000	-0.1	-3.2	6.5	4.9	6.4	-2.5	6.7	9.9	-1.8	-1.5	0.0
1.250	1.2	-2.2	-0.4	2.5	1.9	-0.3	-0.2	3.6	-5.2	1.5	0.0
1.600	-1.0	-1.6	2.6	4.3	5.8	0.1	4.6	5.3	1.0	4.1	0.0
2.000	1.5	-0.4	3.3	2.1	5.9	1.3	6.5	3.9	3.0	6.9	0.0
2.500	0.2	-1.3	3.0	3.2	7.2	0.5	5.8	4.4	5.7	12.1	0.0
3.150	0.7	-1.3	2.2	1.6	6.3	2.7	10.4	6.7	3.3	*******	0.0
4.000	0.7	-1.5	1.1	1.6	6.8	2.1	6.7	6.0	4.7	*******	0.0

Table A-2.3

Results for Measurements Over Grass, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 21

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	84.0	79.3	72.5	69.5	69.2	64.3	66.1	63.6	59.0	59.3	96.4
0.063	87.6	83.4	76.7	73.0	71.5	62.9	69.5	66.6	59.3	61.9	100.7
0.080	92.7	93.6	90.7	75.5	73.9	65.9	69.9	69.1	57.1	60.9	105.3
0.100	93.0	93.7	79.3	65.6	64.3	71.0	63.1	61.0	66.5	59.0	107.9
0.125	90.9	93.0	77.6	72.0	69.9	76.2	67.0	69.6	75.1	60.9	109.6
0.160	96.4	99.9	79.9	76.7	71.9	92.9	74.0	72.9	79.6	60.2	112.7
0.200	95.3	94.1	74.7	79.1	69.1	92.6	70.2	67.9	75.6	59.7	113.1
0.250	94.6	74.5	65.7	76.3	62.3	71.9	57.7	57.6	74.1	59.0	111.2
0.315	93.4	90.9	70.6	70.0	65.0	76.5	60.6	64.1	72.5	59.1	106.2
0.400	96.7	94.5	76.5	69.2	69.3	77.0	71.1	67.9	67.1	57.7	107.1
0.500	91.7	97.0	75.2	63.9	66.9	73.3	67.3	66.2	67.4	64.5	110.1
0.630	101.9	93.3	93.2	69.2	72.4	76.5	70.0	69.9	69.6	60.5	116.1
0.800	100.4	93.2	92.7	72.2	70.5	91.5	69.3	65.2	72.5	69.2	115.7
1.000	93.6	95.3	91.1	73.4	73.1	92.1	69.5	69.1	74.4	62.0	114.2
1.250	95.3	91.7	96.4	74.5	75.0	90.5	72.7	70.9	73.5	67.1	112.9
1.600	95.9	91.5	77.3	72.4	69.0	76.9	65.7	63.3	60.7	55.5	112.1
2.000	93.7	90.4	79.0	70.9	69.4	74.4	65.0	63.7	64.7	53.4	111.4
2.500	94.0	99.0	77.9	70.7	67.5	72.6	64.7	57.6	59.7	45.2	110.9
3.150	93.2	97.9	74.1	67.0	63.5	69.9	59.4	54.6	55.0	******	109.9
4.000	91.2	96.7	75.6	64.3	62.2	65.6	52.2	47.7	49.0	45.6	109.1
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	10.0

(b) Excess Attenuation, dB

RUN 21

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.0	-4.0	-3.2	-6.2	-4.9	-1.0	-6.3	-6.3	-1.5	-5.1	0.0
0.063	-2.3	-3.9	-3.1	-5.4	-3.9	4.9	-4.4	-5.0	1.7	-3.9	0.0
0.080	-2.3	-3.9	-2.0	-2.0	-1.2	6.9	-0.6	-2.4	9.6	2.3	0.0
0.100	-0.5	-2.0	1.0	9.2	10.5	3.3	2.1	7.7	2.2	6.1	0.0
0.125	3.3	0.4	4.9	4.5	7.6	0.2	5.9	1.7	-4.9	5.9	0.0
0.160	10.9	1.7	6.7	2.9	7.7	-3.4	1.9	0.5	-6.2	9.5	0.0
0.200	11.4	7.8	11.2	0.9	11.9	-2.7	6.0	5.3	-1.9	10.3	0.0
0.250	1.2	15.5	19.3	1.6	15.6	6.0	16.6	14.1	-2.5	8.0	0.0
0.315	-2.7	4.2	8.4	2.8	7.3	-3.7	8.6	2.4	-6.0	3.5	0.0
0.400	-5.1	1.4	3.4	4.5	3.9	-3.3	-1.2	-0.6	0.2	5.7	0.0
0.500	2.9	1.9	7.6	12.7	9.7	3.3	5.5	3.9	2.7	1.6	0.0
0.630	-1.3	1.5	5.6	13.3	10.1	6.0	9.7	7.0	7.3	11.3	0.0
0.800	-0.2	6.2	5.6	9.8	11.5	0.5	9.8	10.0	2.7	2.8	0.0
1.000	0.1	-2.9	5.6	6.9	7.2	-1.9	7.8	4.3	-1.0	7.0	0.0
1.250	2.0	-0.3	-1.2	4.1	3.6	-1.9	1.9	0.6	-2.1	-0.3	0.0
1.600	0.7	-0.9	7.0	5.1	9.5	0.7	7.5	6.6	1.2	9.3	0.0
2.000	2.0	-0.7	4.3	5.4	6.9	1.0	6.5	4.2	3.2	9.7	0.0
2.500	1.0	-0.1	4.3	3.9	7.1	2.0	4.7	7.7	5.6	13.3	0.0
3.150	0.8	-0.3	6.4	5.1	9.6	3.2	6.7	6.6	6.2	******	0.0
4.000	1.7	-0.4	2.9	4.5	6.6	3.2	9.4	7.7	7.4	-1.1	0.0

Table A-2.4

Results for Measurements Over Grass, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 25

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	3 MIC 3	9 MIC 9	10 MIC 10	11 MIC 21
0.050	34.9	79.9	73.9	63.4	67.9	67.2	65.6	63.1	56.0	53.7	96.9
0.063	33.4	94.1	73.3	73.4	72.3	70.4	70.5	63.3	59.2	63.2	101.7
0.030	93.3	39.2	93.2	73.0	77.2	72.1	74.1	71.1	60.3	64.5	106.0
0.100	94.4	90.5	34.6	73.1	77.0	65.4	72.3	67.4	54.4	53.7	103.5
0.125	92.5	90.3	34.4	76.2	74.9	56.7	65.5	59.0	52.3	51.3	109.7
0.160	39.4	92.0	95.6	63.0	65.1	79.3	65.7	63.0	62.1	52.9	112.9
0.200	93.4	33.0	32.2	71.5	65.1	33.4	67.1	60.9	67.3	52.1	112.9
0.250	93.9	76.3	72.7	71.2	62.9	33.5	61.5	56.0	69.3	43.3	110.7
0.315	93.3	76.6	62.0	67.3	59.2	79.3	55.4	49.3	67.3	45.0	106.6
0.400	97.0	31.7	72.9	66.3	66.0	72.1	57.7	54.9	66.3	47.5	106.3
0.500	94.4	33.2	75.7	62.9	65.9	74.0	61.1	59.6	55.3	50.4	110.0
0.630	101.0	96.4	37.3	71.0	76.1	77.5	70.5	66.3	66.3	55.3	116.2
0.300	102.7	91.6	33.7	71.4	77.3	32.6	73.6	71.9	65.2	61.5	115.3
1.000	97.7	92.3	36.6	73.3	76.0	31.3	74.6	71.7	70.3	64.7	114.4
1.250	96.6	94.3	79.4	70.0	70.6	31.9	73.3	63.3	66.7	67.2	112.5
1.600	97.4	36.7	34.3	71.1	73.3	79.9	66.9	65.3	63.6	57.3	111.7
2.000	94.5	91.7	31.2	70.1	73.1	75.1	63.4	61.5	60.4	51.3	111.5
2.500	95.1	91.5	79.3	71.3	69.1	75.2	59.5	55.3	57.3	52.6	110.3
3.150	93.1	33.6	79.3	68.3	63.3	70.6	61.6	55.7	53.0	41.3	110.1
4.000	92.1	33.9	76.6	68.3	66.7	63.4	52.2	45.3	43.2	41.3	109.3
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**10.0**

(b) Excess Attenuation, dB

RUN 25

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	3 MIC 3	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.4	-4.1	-4.1	-4.6	-4.1	-3.4	-5.3	-5.3	1.7	-4.5	0.0
0.063	-2.1	-3.5	-4.2	-4.9	-4.2	-1.3	-5.4	-5.7	3.3	-4.2	0.0
0.030	-2.7	-4.3	-4.3	-5.1	-4.3	0.3	-4.7	-4.3	6.6	-1.3	-0.0
0.100	-1.3	-3.2	-3.2	-2.7	-1.6	10.0	-1.0	1.9	14.9	7.0	-0.0
0.125	1.3	-1.9	-1.9	0.3	1.6	9.3	7.5	12.4	17.7	15.5	-0.0
0.160	3.1	-0.3	0.2	11.7	14.6	-0.1	10.4	10.5	11.4	16.9	0.0
0.200	14.1	3.7	3.5	3.1	14.5	-3.3	9.9	12.5	5.6	17.6	0.0
0.250	1.4	13.2	10.3	6.2	14.5	-6.1	12.2	15.0	1.7	13.9	0.0
0.315	-2.2	9.3	17.4	5.4	14.0	-6.1	14.1	17.0	-1.0	17.9	0.0
0.400	-5.7	3.9	6.6	6.5	7.3	1.2	11.3	11.9	0.5	15.3	-0.0
0.500	0.1	0.5	6.9	13.5	10.5	2.4	11.4	10.1	13.5	15.3	0.0
0.630	-0.3	-1.5	1.5	11.4	6.3	4.9	3.1	5.4	3.9	16.2	0.0
0.300	-2.4	2.9	-0.4	10.5	4.6	-0.7	4.3	3.1	9.3	9.1	0.0
1.000	1.2	0.7	0.2	6.5	4.3	-1.5	1.7	1.5	2.4	4.0	-0.0
1.250	0.3	-3.2	5.4	3.1	7.5	-3.3	0.6	7.0	4.1	-1.3	-0.0
1.600	-1.3	3.5	-1.0	5.3	3.6	-3.0	5.6	3.3	5.5	6.1	-0.0
2.000	1.3	-1.9	2.1	6.0	3.0	1.0	2.9	6.1	7.2	10.4	0.0
2.500	-0.1	-2.6	2.3	3.1	5.3	-0.3	9.6	9.1	7.1	5.4	-0.0
3.150	1.0	-0.3	0.9	3.3	3.3	1.5	4.4	5.3	3.0	10.7	-0.0
4.000	1.0.	-2.5	2.0	0.5	2.1	0.4	9.4	9.4	12.0	2.2	0.0

Table A-2.5

Results for Measurements Over Grass, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 33

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.2	80.4	74.6	70.0	69.4	54.5	67.8	65.0	59.8	59.2	96.9
0.063	88.5	84.4	79.1	74.4	73.5	54.1	70.1	67.0	60.6	65.9	102.0
0.080	93.3	89.2	83.0	77.4	76.4	56.3	70.2	68.8	64.2	67.8	106.3
0.100	93.8	89.9	83.3	70.8	69.4	63.1	71.0	68.3	70.3	71.3	108.3
0.125	92.2	89.7	81.6	68.7	66.0	68.1	71.2	67.9	77.8	67.4	110.2
0.160	87.7	90.7	80.9	76.8	73.9	73.6	70.7	72.2	83.0	59.9	113.0
0.200	86.8	85.2	74.6	73.2	69.4	74.3	69.9	68.4	80.5	64.9	113.2
0.250	94.5	74.9	67.8	77.4	64.8	65.6	59.7	55.3	77.3	63.2	110.8
0.315	93.6	80.6	72.8	71.2	65.8	67.8	65.6	66.0	77.8	67.3	106.4
0.400	96.9	83.5	76.4	70.7	71.9	71.0	74.5	72.6	73.2	71.7	107.0
0.500	92.9	89.1	77.3	69.9	72.7	68.3	73.8	66.9	72.0	72.4	110.5
0.630	102.0	95.3	86.0	73.8	76.8	69.1	75.8	64.4	70.8	71.4	116.6
0.800	101.7	93.2	85.9	77.2	73.1	73.7	72.2	69.6	76.8	72.3	115.9
1.000	98.8	95.6	79.5	79.2	75.2	76.5	75.3	67.8	80.2	71.9	114.3
1.250	95.7	92.9	85.6	73.3	78.3	72.7	79.6	72.8	78.2	68.9	112.6
1.600	96.7	90.7	81.3	74.0	72.3	70.6	70.2	62.9	74.6	62.4	111.8
2.000	94.6	89.5	78.8	76.3	74.9	69.6	68.9	63.7	72.1	60.8	111.6
2.500	96.1	92.3	84.1	71.9	67.8	69.0	67.5	61.1	73.8	56.2	111.4
3.150	93.7	90.5	78.1	68.4	66.9	61.0	62.0	56.3	60.4	52.8	109.7
4.000	91.0	88.0	74.9	70.2	65.2	57.9	58.7	52.9	57.1	46.1	108.7
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	10.0

(b) Excess Attenuation, dB

RUN 33

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.7	-4.6	-4.8	-6.2	-5.6	9.3	-7.5	-7.2	-2.0	-5.0	0.0
0.063	-1.9	-3.5	-4.2	-5.5	-4.6	14.8	-4.7	-4.2	2.2	-6.6	0.0
0.080	-2.4	-4.0	-3.8	-4.2	-3.2	17.0	-0.5	-1.6	3.0	-4.2	0.0
0.100	-0.9	-2.8	-2.1	4.4	5.8	12.1	0.7	0.8	-1.2	-5.7	-0.0
0.125	2.6	-0.7	1.5	3.4	11.1	9.0	2.3	3.1	-6.8	-0.0	0.0
0.160	9.9	1.1	5.0	3.0	5.9	6.2	5.5	1.5	-9.3	10.1	-0.0
0.200	11.0	6.8	11.5	1.8	10.6	5.7	6.5	5.4	-6.7	5.2	-0.0
0.250	0.9	14.7	15.8	0.1	12.7	11.9	14.2	15.9	-6.1	4.3	-0.0
0.315	-2.7	4.6	6.4	1.8	7.2	5.2	3.8	0.7	-11.1	-4.4	0.0
0.400	-5.4	2.3	3.3	2.8	1.6	2.5	-4.7	-5.5	-6.1	-8.5	-0.0
0.500	2.1	0.1	5.9	7.1	4.3	8.7	-0.6	3.5	-1.6	-6.0	0.0
0.630	-0.9	0.0	3.2	9.2	6.2	13.9	3.3	11.9	5.5	0.8	0.0
0.800	-1.3	6.4	2.7	4.9	4.0	8.4	6.1	5.8	-1.4	-1.6	0.0
1.000	-0.0	-2.6	7.3	1.2	5.2	3.9	1.1	5.7	-6.7	-2.8	0.0
1.250	1.4	-1.7	-0.6	5.1	0.1	5.7	-5.3	-1.5	-6.9	-2.3	-0.0
1.600	-0.5	-0.4	2.7	3.3	5.0	6.7	2.8	6.9	-4.8	2.4	-0.0
2.000	1.4	0.5	4.7	0.2	1.6	6.9	3.1	4.7	-3.7	2.1	-0.0
2.500	-0.4	-2.7	-1.2	3.6	7.7	6.5	3.0	5.4	-7.3	3.8	0.0
3.150	0.1	-2.9	2.5	4.0	5.5	11.4	4.7	5.7	1.6	1.3	-0.0
4.000	1.6	-1.9	3.6	-1.0	4.0	11.4	3.8	3.8	-0.4	0.5	-0.0

Table A-2.6

Results for Measurements Over Grass, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 35

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.5	91.7	75.3	71.6	70.8	65.6	68.2	65.4	60.5	59.1	97.0
0.063	89.6	95.4	79.6	75.2	74.2	65.3	69.6	67.3	61.0	63.6	102.1
0.080	93.7	89.6	83.1	77.2	76.1	67.8	69.8	69.5	61.0	62.5	105.5
0.100	94.3	90.5	83.9	70.4	69.0	74.2	71.9	68.4	65.9	62.9	107.4
0.125	92.4	90.1	82.5	70.7	67.3	79.8	73.1	65.0	74.5	61.5	109.2
0.160	93.5	91.9	84.0	80.4	76.5	85.0	74.4	72.1	80.8	65.2	112.5
0.200	86.9	87.6	79.6	81.4	73.4	84.9	73.0	70.3	78.4	61.6	112.8
0.250	95.5	75.4	68.9	80.0	65.4	76.2	62.1	60.0	74.7	62.4	110.5
0.315	94.2	80.5	72.3	73.5	68.3	80.2	64.1	64.5	73.6	58.2	105.5
0.400	97.2	84.2	79.0	73.5	73.6	76.8	67.2	64.4	72.7	63.9	106.2
0.500	93.7	89.2	78.5	69.5	71.5	71.0	60.8	65.3	66.7	66.3	109.7
0.630	102.4	97.3	85.7	73.0	77.8	78.1	67.7	72.8	70.9	65.7	115.7
0.800	102.7	91.7	86.4	73.7	75.6	82.0	74.0	69.9	74.4	69.8	115.2
1.000	99.3	96.0	79.8	76.8	73.4	83.1	67.5	68.5	76.2	67.7	113.6
1.250	96.8	95.2	88.3	78.8	79.3	83.9	74.0	74.1	76.4	66.1	111.8
1.600	97.2	93.5	85.3	74.3	73.4	79.8	65.9	68.2	72.0	65.2	110.9
2.000	94.7	89.7	81.3	74.6	72.1	76.0	64.7	62.7	68.0	60.5	110.7
2.500	96.3	92.5	81.7	74.2	73.4	72.9	62.9	55.8	66.1	57.7	110.5
3.150	94.4	90.4	82.1	74.7	70.1	71.4	62.2	56.1	63.0	53.5	109.2
4.000	91.6	88.0	79.1	68.8	64.8	62.6	54.9	47.5	50.0	48.2	107.7
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**10.0**

(b) Excess Attenuation, dB

RUN 35

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.9	-5.8	-5.4	-7.7	-6.9	-1.7	-7.9	-7.5	-2.6	-4.7	0.0
0.063	-2.9	-4.4	-4.6	-6.2	-5.2	3.7	-4.1	-4.4	2.0	-4.1	0.0
0.080	-3.6	-5.2	-4.7	-4.8	-3.7	4.6	-0.9	-3.1	5.4	0.3	0.0
0.100	-2.3	-4.2	-3.5	3.9	5.3	0.1	-1.1	-0.2	2.3	1.7	0.0
0.125	1.4	-2.1	-0.4	5.4	8.3	-3.7	-0.6	5.0	-4.5	4.9	-0.0
0.160	8.6	-0.6	1.4	-1.1	2.8	-5.7	1.4	1.1	-7.6	4.4	-0.0
0.200	10.5	4.0	6.1	-1.8	6.2	-5.3	3.0	3.1	-5.0	8.1	-0.0
0.250	-0.4	13.9	14.4	-2.8	11.8	1.0	11.5	11.0	-3.7	4.9	0.0
0.315	-4.1	3.8	6.0	-1.3	3.9	-8.0	4.5	1.4	-7.7	3.9	0.0
0.400	-6.5	0.8	-0.0	-0.7	-0.8	-4.0	1.9	2.0	-6.3	-1.8	0.0
0.500	0.5	-0.7	3.9	6.7	4.7	5.2	11.7	4.5	3.1	-0.4	-0.0
0.630	-2.2	-2.9	2.7	9.1	4.3	4.0	10.7	2.8	4.7	5.9	0.0
0.800	-3.0	2.2	1.4	7.8	5.9	-0.5	3.7	5.0	0.5	1.0	0.0
1.000	-1.2	-3.7	6.4	3.0	6.4	-3.3	8.4	4.5	-3.2	1.0	0.0
1.250	-0.5	-4.8	-4.1	-1.1	-1.6	-6.2	-0.3	-3.4	-5.7	0.1	-0.0
1.600	-1.9	0.9	-2.1	2.2	3.1	-3.3	6.4	0.9	-2.9	-1.0	0.0
2.000	0.4	-0.6	1.4	1.1	3.6	-0.3	6.5	5.1	-0.2	1.8	0.0
2.500	-1.5	-3.8	0.4	0.5	1.3	1.8	6.8	10.0	-0.3	1.8	0.0
3.150	-1.1	-3.3	-2.0	-2.7	1.9	0.6	4.1	5.6	-1.3	0.5	-0.0
4.000	-0.0	-2.9	-1.6	-0.5	3.5	5.7	6.7	8.4	5.8	-2.3	-0.0

Table A-2.7
Results for Measurements Over Grass, Source Height = 10 m
(a) One-Third Octave Band Levels, dB

RUN 43

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.7	80.8	74.6	71.3	70.1	65.5	67.3	64.5	61.0	60.6	96.3
0.063	89.2	85.1	79.3	76.6	75.2	64.2	69.4	65.1	63.5	64.9	101.9
0.080	93.7	89.6	83.3	80.1	78.4	63.2	67.7	71.1	69.7	68.1	105.4
0.100	94.1	90.4	84.2	77.1	75.0	72.7	67.0	74.8	75.7	66.2	107.4
0.125	92.6	90.3	83.3	65.4	62.5	78.4	73.6	73.7	80.0	65.1	109.1
0.160	88.7	91.7	82.6	76.7	73.0	84.2	73.3	73.3	82.7	65.8	112.2
0.200	86.1	87.0	77.2	78.0	70.0	85.3	70.9	67.0	81.5	67.4	112.1
0.250	95.1	75.0	69.6	76.7	61.7	82.3	65.5	62.9	76.3	61.5	110.3
0.315	94.1	80.3	70.6	73.2	68.3	72.4	62.4	62.8	70.1	59.7	105.7
0.400	97.3	83.3	77.5	75.1	74.6	79.6	69.0	73.0	73.3	65.3	106.5
0.500	92.5	89.8	79.1	71.5	74.0	74.3	71.7	69.8	71.7	65.3	109.6
0.630	102.4	97.2	88.9	70.8	75.3	79.9	72.8	68.9	73.1	68.8	115.6
0.800	101.8	91.9	88.6	76.5	81.3	84.1	76.1	74.9	70.8	74.5	115.0
1.000	99.2	95.0	83.3	75.7	78.5	84.9	74.3	71.9	73.7	72.1	113.4
1.250	96.5	95.0	87.4	74.2	73.2	83.1	72.8	73.8	72.3	65.1	111.6
1.600	96.9	89.5	84.3	71.9	72.8	78.5	74.3	61.3	71.9	63.5	110.5
2.000	94.7	89.8	78.2	72.6	68.0	75.6	67.0	59.8	72.5	60.3	110.6
2.500	96.0	92.3	83.3	74.9	74.2	75.0	65.7	63.2	67.0	57.6	110.6
3.150	93.9	89.2	81.7	71.6	70.0	72.4	60.3	57.3	64.0	54.2	108.9
4.000	91.4	88.0	76.3	67.6	63.0	67.0	59.3	52.3	55.9	52.1	107.6
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**10.0**

(b) Excess Attenuation, dB

RUN 43

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.8	-5.6	-5.4	-8.1	-6.9	-2.3	-7.6	-7.3	-3.8	-7.0	0.0
0.063	-2.7	-4.3	-4.5	-7.8	-6.4	4.7	-4.1	-2.3	-0.7	-5.7	0.0
0.080	-3.7	-5.3	-5.0	-7.8	-6.1	9.1	1.1	-4.8	-3.4	-5.4	0.0
0.100	-2.1	-4.1	-3.9	-2.8	-0.7	1.6	3.8	-6.6	-7.5	-1.5	0.0
0.125	1.1	-2.4	-1.3	10.6	13.5	-2.4	-1.2	-3.8	-10.1	1.2	0.0
0.160	8.1	-0.7	2.5	2.3	6.0	-5.2	2.2	-0.4	-9.8	3.5	0.0
0.200	10.6	3.9	7.8	0.9	8.9	-6.4	4.4	5.7	-8.8	1.6	0.0
0.250	-0.2	14.1	13.5	0.3	15.3	-5.3	7.9	7.9	-5.5	5.5	-0.0
0.315	-3.8	4.2	7.9	-0.8	4.1	-0.0	6.2	3.2	-4.1	2.5	0.0
0.400	-6.3	2.0	1.8	-2.0	-1.5	-6.5	0.4	-6.3	-6.6	-2.5	-0.0
0.500	1.6	-1.4	3.2	4.6	2.1	1.8	0.7	-0.2	-2.1	0.4	-0.0
0.630	-2.3	-2.9	-0.6	11.2	6.7	2.1	5.4	6.5	2.3	2.6	0.0
0.800	-2.3	1.8	-1.0	4.8	-0.0	-2.8	1.3	-0.3	3.8	-4.1	0.0
1.000	-1.3	-2.9	2.6	3.8	1.0	-5.4	1.3	0.8	-1.0	-3.7	0.0
1.250	-0.4	-4.8	-3.4	3.3	4.3	-5.6	0.7	-3.4	-1.9	0.8	-0.0
1.600	-2.0	-0.5	-1.5	4.2	3.3	-2.4	-2.4	7.4	-3.2	0.3	0.0
2.000	0.3	-0.8	4.4	3.0	7.6	0.0	4.2	7.9	-4.8	2.0	-0.0
2.500	-1.1	-3.5	-1.1	-0.1	0.6	-0.2	4.2	2.8	-1.0	2.2	-0.0
3.150	-0.9	-2.4	-1.8	0.2	1.8	-0.6	6.0	4.4	-2.3	-0.1	-0.0
4.000	0.1	-3.0	1.3	0.9	5.5	1.5	2.6	4.0	0.4	-5.5	-0.0

Table A-3.1

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 10

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.3	81.6	74.8	72.5	71.6	66.5	70.4	73.3	57.1	62.9	98.9
0.063	91.5	87.1	80.8	78.8	77.6	69.2	75.4	78.4	57.9	66.7	104.3
0.080	95.5	92.0	85.4	83.6	82.3	70.2	78.9	79.9	58.9	69.9	107.6
0.100	97.2	92.3	85.5	82.7	80.7	62.9	76.4	75.5	50.6	61.9	105.3
0.125	96.6	91.8	83.7	77.3	75.2	63.6	70.5	67.2	56.5	47.4	112.4
0.160	99.5	95.1	84.7	79.1	76.3	73.4	65.8	67.1	68.0	52.2	112.2
0.200	95.2	90.2	71.8	71.0	62.5	78.5	64.2	67.4	71.4	55.8	114.6
0.250	87.0	82.0	63.7	73.1	60.4	80.2	58.5	64.5	70.7	63.6	112.5
0.315	88.7	72.5	69.0	74.9	69.5	77.6	67.9	69.8	60.1	61.2	106.9
0.400	88.2	83.4	77.5	76.1	76.5	68.0	72.0	73.8	60.6	62.3	108.3
0.500	95.8	85.4	77.1	68.7	70.8	73.3	73.0	74.3	61.3	65.1	111.2
0.630	102.3	90.3	80.4	71.2	76.1	70.6	67.8	70.2	65.4	65.3	116.7
0.800	93.7	93.5	83.6	70.6	75.2	77.1	74.9	73.3	69.2	70.4	116.3
1.000	100.3	89.1	81.9	75.4	73.8	77.6	67.3	74.0	68.3	64.4	114.6
1.250	98.3	91.0	82.3	75.4	77.2	79.0	75.7	77.6	68.5	69.1	112.9
1.600	94.9	91.5	81.9	71.7	72.2	76.0	67.8	70.0	66.2	61.4	113.1
2.000	94.7	87.5	74.3	74.5	69.7	70.7	63.6	67.9	59.9	55.9	111.8
2.500	97.5	89.2	77.7	70.3	70.3	71.8	63.0	64.1	56.6	54.8	111.2
3.150	95.6	83.0	74.8	66.9	65.0	67.9	53.3	57.6	51.8	52.9	110.6
4.000	94.1	86.3	70.9	63.9	63.1	63.4	55.6	58.9	*******	57.3	109.1
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 10

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.7	-4.9	-4.1	-7.9	-7.0	-1.8	-9.3	-14.7	1.5	-7.8	-1.2
0.063	-3.8	-5.3	-5.1	-9.1	-7.9	0.5	-9.2	-14.7	5.7	-6.6	-1.5
0.080	-5.0	-6.5	-5.9	-10.1	-8.8	3.3	-8.9	-12.5	8.6	-6.0	-1.0
0.100	-3.3	-4.4	-3.6	-6.8	-4.8	13.0	-4.1	-5.7	19.2	4.3	3.2
0.125	-0.9	-2.1	0.0	0.4	2.5	14.0	3.6	4.4	15.0	20.6	-1.6
0.160	-1.2	-2.8	1.6	1.1	3.9	6.8	10.8	6.9	6.1	3.3	1.2
0.200	3.7	2.7	15.1	9.8	18.2	2.3	13.0	7.2	3.2	5.1	-0.6
0.250	9.9	8.9	21.2	5.6	13.3	-1.5	16.6	8.0	1.8	5.2	-0.5
0.315	8.2	13.4	10.8	-1.2	4.2	-3.9	2.1	-2.4	7.3	2.4	0.1
0.400	4.1	2.9	2.7	-2.1	-2.5	6.0	-1.6	-6.1	7.1	1.5	-0.9
0.500	-0.0	4.4	6.6	8.8	6.7	4.2	0.8	-3.3	9.7	2.0	-0.3
0.630	-0.7	5.2	9.0	12.0	7.1	12.6	11.6	6.5	11.3	7.4	0.0
0.800	7.6	1.7	5.5	12.1	7.5	5.6	4.0	2.8	6.9	1.6	0.1
1.000	-0.8	4.4	5.4	5.5	7.1	3.3	9.2	0.1	5.3	5.4	0.1
1.250	-0.8	0.9	3.3	3.7	1.9	0.1	-0.6	-5.6	3.6	-1.7	0.3
1.600	2.6	-0.2	3.0	6.5	6.0	2.2	6.1	0.7	4.5	4.3	0.6
2.000	1.9	2.9	9.5	2.2	7.0	6.0	8.6	0.7	8.7	7.0	0.1
2.500	-1.1	0.8	5.5	5.3	5.3	3.8	7.5	2.3	9.8	4.9	0.6
3.150	-0.4	0.7	6.6	6.1	8.0	5.1	8.8	4.5	10.3	0.3	0.2
4.000	-0.2	0.8	8.3	5.6	6.4	6.1	6.7	-2.8	*******	-12.1	0.7

Table A-3.2

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

Run 14

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.1	81.2	74.8	71.8	70.9	67.6	69.3	67.3	63.4	63.6	98.2
0.063	90.9	86.5	80.5	77.6	76.4	71.1	74.4	72.9	65.2	67.5	103.3
0.080	95.8	91.3	84.9	82.7	81.3	72.9	78.2	75.5	66.0	68.0	107.2
0.100	97.2	92.5	86.0	82.8	80.9	69.2	77.3	72.5	59.2	63.6	105.7
0.125	96.1	91.5	84.7	78.9	76.6	59.2	70.1	65.6	57.5	52.4	111.7
0.160	98.5	94.7	86.5	77.9	75.0	71.2	67.8	57.8	66.7	55.0	111.7
0.200	94.7	90.7	79.7	71.9	66.4	76.0	59.8	58.5	72.4	56.2	113.9
0.250	84.3	81.9	64.6	64.0	52.3	79.6	57.1	55.2	75.2	51.9	111.1
0.315	82.3	68.1	59.6	65.1	59.7	78.6	55.1	55.5	74.8	54.3	106.1
0.400	86.0	77.6	69.1	67.9	68.1	78.5	66.0	64.7	71.9	61.0	107.5
0.500	94.5	83.9	72.8	68.4	72.2	71.7	69.3	64.8	68.4	60.7	110.3
0.630	103.4	93.6	82.6	71.4	77.5	76.0	70.5	67.3	69.2	67.1	116.2
0.800	98.2	96.2	87.7	72.8	79.3	79.3	76.8	72.1	72.1	66.5	115.8
1.000	98.8	96.0	89.6	75.1	80.9	79.3	77.4	71.6	76.3	73.6	114.3
1.250	100.2	87.2	84.4	73.1	71.8	79.0	75.4	67.8	71.9	64.7	112.4
1.600	90.8	91.0	81.4	73.0	73.5	76.2	67.4	62.6	66.9	56.5	111.6
2.000	98.0	87.9	80.0	69.1	70.7	72.7	68.5	59.3	61.7	53.6	111.4
2.500	97.9	90.3	77.3	72.1	69.1	71.1	62.3	57.5	60.2	53.8	111.0
3.150	94.8	88.2	75.8	66.7	65.7	69.2	61.5	55.2	56.8	40.0	110.0
4.000	94.8	88.5	75.7	64.1	61.4	63.4	53.4	46.9	49.9	◆◆◆◆◆◆◆	108.9
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**5.0**

(b) Excess Attenuation, dB

RUN 14

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.8	-4.8	-4.5	-7.5	-6.5	-3.3	-8.5	-9.0	-5.2	-8.9	-0.8
0.063	-4.4	-6.0	-6.0	-9.1	-7.9	-2.6	-9.4	-10.4	-3.7	-8.6	-2.2
0.080	-4.7	-6.2	-5.8	-9.6	-8.2	0.2	-9.6	-8.5	1.1	-4.5	-1.0
0.100	-3.5	-4.8	-4.3	-7.1	-5.2	6.5	-5.2	-2.9	10.4	2.4	3.1
0.125	-1.1	-2.5	-1.7	-2.0	0.3	17.7	3.3	5.2	13.3	14.9	-1.6
0.160	-0.6	-2.6	-0.6	1.9	4.8	3.6	8.4	15.9	7.0	15.0	1.3
0.200	3.8	1.8	6.8	8.5	14.0	4.4	17.0	15.7	1.7	14.3	-0.3
0.250	11.6	8.0	19.2	13.7	25.4	-1.9	16.9	16.3	-3.8	15.8	-0.1
0.315	8.7	16.9	19.3	7.6	13.0	-5.9	13.9	10.9	-8.4	8.2	0.0
0.400	6.1	8.5	10.9	5.8	5.6	-4.3	4.0	2.6	-4.6	2.4	-0.3
0.500	0.5	5.0	10.0	8.2	4.4	4.9	3.5	5.2	1.6	5.3	-0.2
0.630	-2.2	1.5	6.4	11.3	5.1	6.7	8.3	8.2	6.8	4.8	0.1
0.800	2.6	-1.4	0.9	9.4	2.4	2.9	1.5	3.4	3.4	4.7	0.2
1.000	0.3	-3.0	-2.8	5.2	-0.6	1.0	-1.0	1.8	-2.9	-4.6	0.0
1.250	-2.8	4.1	0.6	5.3	6.6	-0.6	-1.1	3.4	-0.7	1.8	0.2
1.600	5.8	-0.5	2.7	4.3	3.8	1.1	5.5	7.0	2.7	8.0	0.3
2.000	-1.9	1.9	3.3	7.0	5.4	3.4	3.0	8.6	6.2	8.4	0.0
2.500	-2.3	-1.6	5.1	2.6	5.6	3.6	7.3	7.9	5.2	4.8	0.0
3.150	-0.2	-0.2	5.0	5.6	6.6	3.1	4.9	6.3	4.6	13.0	0.2
4.000	-1.6	-2.1	2.8	4.7	7.4	5.4	8.2	8.4	5.4	◆◆◆◆◆◆◆	0.2

Table A-3.3

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 20

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.7	81.0	74.9	72.8	71.8	67.1	70.3	68.5	56.5	62.9	98.2
0.063	90.2	86.0	80.5	78.3	77.0	68.9	74.1	72.3	57.1	66.0	103.3
0.080	95.8	91.4	85.6	83.3	81.8	69.5	78.1	75.6	59.9	70.1	107.0
0.100	96.6	91.7	85.1	82.7	80.6	63.7	76.6	70.5	50.8	62.8	105.2
0.125	96.0	90.4	81.1	76.3	73.8	68.3	63.1	61.3	60.9	54.0	112.3
0.160	97.8	92.1	79.8	74.1	70.6	76.4	67.9	64.1	69.9	65.4	111.5
0.200	93.9	86.4	76.1	76.3	66.5	82.4	69.1	67.0	73.9	66.5	114.0
0.250	79.6	71.8	69.8	77.2	65.5	81.2	61.4	60.2	64.2	54.9	111.3
0.315	85.4	77.5	71.5	74.4	69.8	69.3	62.8	59.0	59.2	57.4	106.2
0.400	88.6	93.7	75.3	71.9	72.1	73.9	67.8	70.7	64.1	65.7	107.6
0.500	93.5	84.5	73.8	71.0	73.2	72.5	71.4	68.9	61.0	62.5	111.0
0.630	99.8	89.4	78.3	69.6	72.5	77.2	74.9	67.5	67.9	65.5	116.3
0.800	92.7	89.5	80.7	74.3	73.7	75.4	63.5	67.0	67.5	64.8	115.7
1.000	100.7	85.9	75.2	75.4	75.3	79.5	73.7	67.3	70.7	62.4	114.3
1.250	96.4	93.4	84.1	77.6	78.3	78.1	73.4	67.6	69.0	67.1	112.5
1.600	94.3	89.1	77.4	76.8	73.6	73.9	65.2	64.7	63.0	56.3	111.8
2.000	93.1	89.6	78.5	75.9	72.0	72.6	63.8	62.1	61.0	56.8	111.2
2.500	94.5	86.0	73.9	69.2	66.3	73.1	63.8	56.7	57.0	40.8	110.8
3.150	93.8	86.0	72.8	69.5	65.1	67.4	56.0	54.5	47.4	41.8	110.1
4.000	90.9	87.3	70.8	66.5	62.2	62.6	54.6	44.5	39.1	46.1	108.7
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**5.0**

(b) Excess Attenuation, dB

RUN 20

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.4	-5.6	-5.6	-9.5	-8.5	-3.8	-10.5	-11.2	0.8	-9.1	-1.8
0.063	-4.6	-6.4	-6.9	-10.7	-9.4	-1.3	-10.0	-10.7	4.5	-8.0	-2.6
0.080	-5.1	-6.7	-6.9	-10.6	-9.1	4.2	-8.9	-9.0	7.8	-7.0	-1.2
0.100	-3.8	-4.9	-4.3	-7.9	-5.8	11.1	-5.4	-1.8	17.9	2.4	2.7
0.125	-1.5	-1.9	1.4	0.2	2.7	8.2	9.8	9.1	9.5	12.8	-2.7
0.160	-0.2	-0.5	5.8	5.4	8.9	3.1	8.0	9.3	3.5	4.4	1.2
0.200	4.1	5.6	9.9	3.6	13.4	-2.5	7.2	6.7	-0.2	3.5	-0.9
0.250	16.5	18.3	14.2	0.7	12.4	-3.3	12.9	11.5	7.5	13.0	-0.1
0.315	5.7	7.6	7.5	-1.6	3.0	3.5	6.4	7.5	7.4	5.3	0.0
0.400	3.4	2.3	4.6	1.8	1.6	-0.2	2.2	-3.4	3.2	-2.3	-0.5
0.500	1.5	4.4	9.0	5.6	3.4	4.1	1.4	1.2	9.1	3.6	-0.9
0.630	1.2	5 5	10.5	12.9	10.0	5.3	3.8	8.4	8.0	6.4	-0.2
0.800	7.8	5.0	7.6	7.7	8.3	6.6	9.6	8.3	7.8	6.3	0.0
1.000	-1.7	7.1	11.5	4.9	5.0	0.8	2.7	6.1	2.7	6.6	-0.1
1.250	1.2	-1.9	1.1	1.0	0.3	0.5	1.2	3.9	2.5	-0.2	0.3
1.600	2.1	1.6	6.9	0.8	4.0	3.7	8.1	5.3	7.0	8.7	0.3
2.000	3.0	0.3	4.8	0.3	4.2	3.6	7.8	6.0	7.1	5.6	0.2
2.500	0.9	3.0	8.3	5.5	8.4	1.6	5.8	8.8	8.5	18.0	0.0
3.150	0.5	1.8	7.8	2.7	7.2	4.9	10.4	7.1	14.1	11.5	-0.2
4.000	2.4	-0.9	7.8	2.6	6.9	6.5	7.4	11.5	16.9	-0.8	0.4

Table A-3.4

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 26

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.3	80.0	74.1	69.4	68.8	68.5	66.7	64.7	56.7	59.8	97.6
0.063	99.9	85.0	79.5	75.1	74.4	72.6	72.2	70.7	60.3	65.9	102.9
0.080	95.6	90.6	85.0	80.9	80.1	75.8	77.6	75.3	62.5	69.2	106.8
0.100	97.0	91.8	86.2	81.5	80.5	73.3	77.2	72.7	55.9	64.1	105.8
0.125	96.2	91.1	85.2	78.9	77.7	66.9	71.5	65.3	48.3	53.1	111.6
0.160	98.3	94.1	87.0	77.2	75.1	61.9	65.2	58.8	51.8	42.7	111.4
0.200	94.8	90.6	81.4	66.1	63.3	74.0	59.3	49.4	58.9	43.7	113.8
0.250	88.4	82.8	71.1	63.7	55.2	77.7	53.3	47.9	62.7	43.2	111.6
0.315	82.8	69.3	58.6	60.2	53.0	79.1	50.6	48.1	63.9	43.9	106.1
0.400	85.6	75.1	67.0	62.2	61.8	80.0	54.0	56.6	65.8	49.8	107.4
0.500	93.9	81.7	72.0	63.4	66.5	74.5	64.5	62.9	61.7	55.8	110.3
0.630	102.9	92.9	82.9	70.0	75.3	71.9	69.0	68.1	61.0	59.2	116.2
0.800	97.7	96.6	88.1	72.1	79.5	82.1	70.6	70.5	67.7	59.4	115.8
1.000	98.8	96.5	88.1	67.1	74.8	82.9	76.6	77.0	66.7	69.1	114.4
1.250	100.3	87.5	84.5	66.8	74.8	81.3	77.9	67.2	66.3	67.4	112.4
1.600	91.1	90.5	77.0	71.3	69.6	76.8	66.1	62.4	63.9	53.8	111.5
2.000	97.5	89.5	82.0	69.8	74.5	75.6	66.4	64.8	60.8	51.5	111.4
2.500	97.7	91.2	79.3	69.1	69.4	74.1	64.9	57.7	54.7	46.7	110.8
3.150	95.1	87.3	76.7	65.5	67.6	71.2	57.3	51.3	49.4	38.5	109.9
4.000	94.7	88.7	75.9	63.6	62.4	66.8	53.0	43.8	42.5	42.4	109.1
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 26

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.5	-4.1	-4.3	-5.6	-5.0	-4.7	-6.5	-6.9	1.1	-5.6	-0.7
0.063	-3.3	-4.4	-4.9	-6.5	-5.8	-4.0	-7.1	-8.1	2.2	-6.9	-1.2
0.080	-4.7	-5.7	-6.1	-8.0	-7.2	-2.9	-8.2	-8.5	4.4	-5.9	-0.8
0.100	-3.6	-4.4	-4.8	-6.1	-5.1	2.1	-5.4	-3.4	13.4	1.6	2.7
0.125	-1.6	-2.5	-2.6	-2.4	-1.2	9.6	1.5	5.1	22.1	13.7	-1.9
0.160	-0.5	-2.3	-1.2	2.5	4.6	17.8	10.9	14.8	21.7	27.2	1.5
0.200	3.0	1.2	4.4	13.5	16.3	5.6	16.7	24.1	14.5	26.0	-0.9
0.250	12.2	6.8	12.4	13.7	22.2	-0.3	20.4	23.2	8.4	24.1	-0.9
0.315	8.7	16.2	20.8	13.0	20.2	-5.9	18.8	18.7	2.9	19.0	0.5
0.400	6.1	10.5	12.5	11.1	11.5	-6.7	15.6	10.2	1.0	13.0	-0.6
0.500	1.0	7.1	10.7	13.0	9.9	1.9	8.1	6.9	8.1	9.9	-0.3
0.630	-1.9	2.1	6.0	12.5	7.2	10.6	9.6	7.7	14.8	12.4	0.0
0.800	2.9	-2.0	0.3	9.8	2.4	-0.2	7.4	4.6	7.4	11.4	0.0
1.000	0.4	-3.4	-1.2	13.2	5.5	-2.6	-0.3	-3.7	6.6	-0.3	-0.0
1.250	-3.0	3.7	0.3	11.4	3.4	-3.1	-3.9	3.7	4.6	-1.3	0.1
1.600	5.3	-0.2	6.8	5.7	7.4	0.2	6.5	6.9	5.4	10.2	0.2
2.000	-1.3	0.4	1.3	6.3	1.6	0.5	5.1	3.0	7.0	10.4	0.1
2.500	-2.3	-2.2	2.8	5.4	5.1	0.4	4.4	7.4	10.4	11.5	-0.0
3.150	-0.6	0.6	4.0	6.7	4.6	1.0	8.9	10.0	11.9	13.3	0.2
4.000	-1.3	-2.1	2.8	5.4	6.6	2.2	8.8	11.7	13.1	2.2	0.2

Table A-3.5

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 32

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.3	91.1	75.3	72.1	71.4	67.3	70.5	63.1	62.3	62.9	99.1
0.063	91.1	86.3	81.7	73.2	77.4	70.2	75.6	73.3	64.9	66.3	104.1
0.080	96.0	91.2	86.1	83.0	81.9	70.5	73.7	74.7	65.5	67.3	106.3
0.100	97.2	92.1	86.7	82.0	80.7	65.1	76.1	69.6	53.3	61.2	106.3
0.125	96.2	91.3	84.3	76.6	75.3	63.6	70.4	61.3	63.0	51.0	112.1
0.160	93.1	93.3	84.3	77.5	74.9	77.2	66.5	65.4	74.9	60.6	111.3
0.200	93.4	83.4	74.0	74.1	65.6	81.7	70.6	66.9	77.6	60.9	113.3
0.250	80.5	79.1	60.4	75.9	64.0	82.2	65.0	62.5	72.7	56.4	111.9
0.315	84.0	71.0	66.4	73.3	69.0	76.4	65.3	61.5	70.5	59.0	105.9
0.400	86.3	73.3	76.3	75.5	76.2	63.7	63.1	67.5	69.4	56.0	103.0
0.500	95.3	85.0	79.9	70.3	72.4	70.6	72.0	64.9	63.9	62.0	110.7
0.630	102.3	93.3	84.2	67.2	71.6	73.1	74.9	65.4	71.3	70.7	116.5
0.800	95.4	96.3	86.4	71.4	73.3	77.6	79.6	67.7	73.3	69.1	115.9
1.000	100.5	92.2	83.5	63.9	71.4	79.2	76.3	66.9	72.1	66.3	114.6
1.250	99.3	89.2	82.0	70.3	74.9	73.6	76.3	76.6	72.7	65.0	112.3
1.600	94.7	92.6	82.3	72.6	70.0	75.6	71.4	67.5	67.1	62.2	112.0
2.000	95.0	85.3	76.7	71.9	67.7	73.1	67.1	53.9	66.3	59.1	111.3
2.500	96.9	90.3	79.9	71.2	70.1	72.6	65.3	59.6	62.2	53.1	111.4
3.150	95.3	83.9	76.2	69.5	67.7	70.1	62.7	51.4	56.3	52.0	110.1
4.000	93.6	86.9	73.9	67.4	62.9	65.7	59.0	45.5	53.9	47.3	109.0
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 32

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.5	-5.2	-6.0	-3.3	-7.6	-3.5	-10.2	-10.3	-5.0	-3.7	-2.2
0.063	-4.2	-5.4	-6.3	-9.3	-9.5	-1.3	-10.2	-10.4	-2.0	-7.0	-2.1
0.080	-4.3	-6.0	-6.9	-9.3	-3.7	2.7	-9.0	-7.5	1.7	-4.2	-0.5
0.100	-4.0	-4.9	-5.5	-6.3	-5.5	10.1	-4.5	-0.5	10.3	4.3	2.0
0.125	-1.1	-2.2	-1.7	0.5	1.3	3.5	3.1	9.7	3.0	16.4	-1.9
0.160	-0.2	-1.9	1.1	2.3	4.9	2.6	9.7	3.3	-1.2	9.4	1.2
0.200	4.7	2.7	12.1	5.9	14.4	-1.7	5.3	6.9	-3.3	9.2	-0.6
0.250	15.2	10.6	23.2	1.6	13.5	-4.7	3.9	3.7	-1.5	11.1	-1.1
0.315	7.3	14.3	12.3	-0.3	4.0	-3.4	4.1	5.2	-3.3	3.9	0.5
0.400	5.1	7.6	3.5	-2.0	-2.7	4.3	1.7	-0.4	-2.3	7.2	-1.0
0.500	0.1	4.3	3.3	6.7	4.6	6.4	1.2	5.6	1.6	4.5	-0.2
0.630	-1.3	1.6	5.1	15.3	11.4	4.9	4.2	11.0	5.1	1.6	0.1
0.800	5.3	-2.1	2.1	10.7	3.3	4.5	-1.3	7.7	2.1	2.1	0.0
1.000	-1.4	0.9	3.3	11.5	9.0	1.2	-0.4	6.6	1.4	2.3	-0.3
1.250	-1.9	2.1	3.0	7.6	3.5	-0.2	-2.4	-5.3	-1.4	1.7	-0.2
1.600	1.9	-2.2	1.7	4.7	7.3	1.7	1.6	2.3	2.7	2.5	-0.2
2.000	1.3	4.3	6.9	4.6	3.3	3.4	4.3	9.5	1.6	3.7	-0.2
2.500	-0.9	-0.6	3.0	4.2	5.3	2.3	4.6	6.3	4.2	1.3	0.0
3.150	-1.1	-1.3	4.3	2.3	4.6	2.2	3.9	10.5	5.6	2.0	-0.4
4.000	-0.7	-0.3	4.6	1.7	6.2	3.4	3.3	11.0	2.6	-1.5	-0.3

Table A-3.6

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 36

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC* 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	87.1	91.8	76.1	73.3	72.3	58.7	70.7	69.0	63.3	64.0	93.3
0.063	92.2	87.2	82.0	79.3	78.0	61.8	75.5	74.0	65.1	66.7	104.0
0.080	96.4	91.4	85.3	83.2	81.3	62.5	78.0	74.5	63.7	67.4	105.7
0.100	97.5	92.1	86.4	82.2	80.4	58.0	75.3	70.9	56.2	60.3	105.3
0.125	96.7	91.4	85.5	76.5	74.6	63.0	72.2	60.5	67.5	51.5	111.2
0.160	93.8	94.0	86.3	79.4	75.3	70.9	70.9	69.4	77.4	58.9	110.9
0.200	95.2	90.9	79.4	80.7	74.0	74.5	73.7	68.3	78.3	61.0	112.9
0.250	84.4	83.6	63.7	80.3	67.5	74.4	71.6	61.8	77.6	63.7	111.3
0.315	84.9	70.3	67.6	75.5	70.2	63.7	58.1	62.2	69.0	57.5	104.3
0.400	87.1	80.2	77.9	76.8	76.2	63.5	68.0	64.1	72.4	65.3	107.0
0.500	94.8	84.3	78.2	69.3	72.4	63.5	71.5	68.4	67.7	61.6	109.3
0.630	102.8	92.6	82.8	67.6	74.9	71.1	73.2	73.6	71.8	64.9	115.7
0.800	96.2	96.5	84.4	65.4	70.2	72.7	79.2	77.6	70.0	66.2	115.2
1.000	101.0	90.5	80.3	73.4	75.6	68.5	75.5	73.3	73.3	66.3	113.7
1.250	99.9	91.6	83.1	74.8	76.7	65.6	70.4	72.8	71.1	62.6	111.3
1.600	93.7	92.3	83.4	75.6	76.3	59.0	66.3	66.7	68.2	61.9	110.7
2.000	95.4	96.0	76.1	74.7	73.4	58.5	63.1	67.2	65.0	50.4	110.9
2.500	99.0	93.2	82.5	69.2	68.4	58.7	60.5	67.5	65.7	50.6	110.6
3.150	96.3	91.1	77.1	68.9	67.1	56.9	56.6	61.1	63.0	48.4	109.3
4.000	94.7	96.1	71.3	65.8	56.3	51.0	49.6	51.5	56.7	48.8	107.9
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 36

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC* 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.2	-5.8	-6.2	-9.4	-8.4	5.2	-10.3	-11.1	-5.4	-9.6	-1.8
0.063	-5.2	-6.2	-7.0	-10.3	-9.0	7.2	-10.0	-11.0	-2.1	-7.3	-1.9
0.080	-6.0	-7.0	-7.4	-10.8	-9.4	9.9	-9.1	-8.1	2.7	-4.6	-0.2
0.100	-5.2	-5.8	-6.1	-7.9	-6.1	16.3	-5.1	-2.7	12.0	3.9	1.6
0.125	-2.6	-3.3	-3.4	-0.4	1.5	13.1	0.3	9.5	2.5	14.9	-2.0
0.160	-1.4	-2.6	-0.9	-0.1	3.5	3.4	4.9	3.3	-4.2	10.7	1.6
0.200	2.5	0.8	6.3	-1.1	5.6	5.1	2.3	4.6	-4.9	8.7	-0.1
0.250	11.0	5.8	19.7	-3.1	9.7	2.8	2.0	9.2	-6.6	3.6	-0.8
0.315	5.5	14.1	10.7	-3.3	2.0	8.5	10.4	3.7	-3.1	4.6	0.7
0.400	4.0	4.9	1.1	-4.0	-3.4	9.3	1.1	2.4	-5.9	-2.7	-0.8
0.500	-0.2	4.3	4.3	6.9	3.8	12.8	1.0	1.4	2.1	4.3	-0.1
0.630	-2.2	1.9	5.6	14.6	7.3	11.1	5.2	2.1	3.9	6.3	0.0
0.800	3.9	-2.5	3.5	16.2	11.4	8.9	-1.5	-2.7	4.9	4.6	0.0
1.000	-2.6	1.9	5.9	6.4	4.2	11.3	0.4	-0.8	-0.3	2.5	-0.1
1.250	-3.3	-1.1	1.2	3.0	1.1	12.2	3.4	-2.0	-0.3	3.7	-0.0
1.600	2.0	-2.8	-0.2	0.9	0.2	17.5	6.0	2.5	1.0	2.4	0.2
2.000	0.0	3.2	6.6	1.1	2.4	17.3	8.2	0.7	2.9	12.0	-0.2
2.500	-3.9	-4.4	-0.4	5.5	6.3	16.0	9.3	-1.5	0.3	9.1	-0.1
3.150	-2.6	-3.9	3.1	3.2	5.0	15.2	9.9	0.8	-1.1	5.9	-0.1
4.000	-2.7	-0.9	6.3	2.7	11.7	17.5	12.3	4.7	-0.5	-2.4	-0.2

*Calibration questionable, data not used for averages.

Table A-3.7

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 42

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.7	81.5	75.9	73.6	72.5	67.7	70.9	63.4	62.5	61.6	93.3
0.063	92.0	87.0	82.1	79.7	79.5	70.5	75.3	73.1	65.3	66.9	103.3
0.080	96.4	91.4	86.2	83.7	82.3	70.4	77.7	74.5	64.9	63.3	105.4
0.100	97.1	91.7	86.1	81.5	79.6	65.3	75.1	69.7	60.4	61.3	105.9
0.125	96.5	91.2	84.6	76.1	74.1	71.1	72.1	65.5	72.1	55.3	111.0
0.160	93.6	93.6	84.3	77.7	74.1	77.4	66.5	71.2	73.1	60.5	111.6
0.200	93.3	89.1	73.7	71.5	65.1	80.3	69.5	69.3	77.9	61.6	112.5
0.250	81.3	80.3	64.5	69.0	55.0	82.9	63.6	64.4	72.7	53.5	111.1
0.315	84.3	71.6	66.1	63.1	63.3	80.0	65.5	66.6	63.0	43.9	105.3
0.400	87.2	73.6	74.6	72.1	72.1	77.7	71.0	69.3	63.2	63.1	107.0
0.500	95.3	84.3	75.3	67.9	69.3	75.9	69.6	67.3	67.3	66.0	109.9
0.630	102.2	92.3	82.4	64.2	69.3	81.9	75.3	74.1	75.0	69.4	115.6
0.800	94.4	95.9	81.7	74.7	73.4	79.6	79.0	74.5	77.0	70.4	115.1
1.000	100.7	90.2	82.4	76.4	73.3	84.5	77.5	72.0	80.6	65.7	113.5
1.250	93.6	89.5	80.9	73.4	73.7	79.1	73.3	75.9	77.5	69.9	111.7
1.600	94.2	91.3	80.3	73.1	75.3	79.0	71.3	66.9	71.1	66.1	111.0
2.000	95.1	84.3	76.5	69.1	70.6	73.2	64.6	65.2	63.2	53.6	110.9
2.500	97.4	92.1	73.1	70.3	70.3	74.5	67.3	61.9	63.3	53.3	110.5
3.150	94.3	89.0	75.7	63.6	66.3	76.7	66.3	60.0	62.1	49.9	109.3
4.000	94.7	95.3	74.3	65.2	62.6	73.9	63.3	54.0	56.0	51.2	103.1
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**5.0**

(b) Excess Attenuation, dB

RUN 42

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.5	-6.2	-6.7	-10.4	-9.3	-4.5	-11.2	-11.3	-5.4	-7.9	-2.5
0.063	-5.2	-6.2	-7.3	-10.9	-9.7	-1.7	-10.5	-10.3	-2.5	-7.7	-1.9
0.080	-6.1	-7.1	-7.9	-11.4	-10.0	1.9	-9.9	-3.2	1.4	-5.6	0.0
0.100	-4.3	-5.4	-5.3	-7.2	-5.3	9.0	-4.4	-1.5	7.3	3.3	1.5
0.125	-2.5	-3.2	-2.6	-0.1	1.9	4.9	0.3	4.4	-2.2	11.0	-1.9
0.160	-1.5	-2.5	0.3	1.3	4.9	1.6	9.0	1.7	-5.2	3.7	0.6
0.200	3.2	1.9	11.3	7.4	13.3	-1.9	5.3	3.4	-5.2	7.4	-0.4
0.250	13.4	3.9	13.7	3.0	22.0	-5.9	9.3	6.4	-1.9	3.6	-0.3
0.315	5.3	13.0	12.4	4.3	3.6	-7.6	3.2	-0.5	-1.9	13.4	0.4
0.400	4.2	6.3	4.7	1.0	1.0	-4.6	-1.6	-3.0	-1.4	-0.2	-0.5
0.500	-0.3	4.2	6.6	3.2	6.3	0.2	2.3	2.4	2.4	-0.2	-0.3
0.630	-1.7	1.6	5.9	17.9	12.7	0.1	2.5	1.4	0.5	2.1	0.0
0.800	5.4	-2.1	6.0	6.6	2.9	1.7	-1.5	0.2	-2.3	0.2	-0.1
1.000	-2.5	2.0	3.6	3.2	1.3	-4.9	-1.3	0.3	-7.3	2.3	-0.1
1.250	-2.2	0.3	3.2	4.2	3.9	-1.5	-4.3	-5.4	-7.0	-3.9	-0.1
1.600	1.1	-2.7	2.5	3.0	0.3	-2.9	0.6	1.3	-2.4	-2.2	-0.5
2.000	0.2	4.3	6.1	6.6	5.1	-2.5	6.6	2.5	-0.5	3.7	-0.3
2.500	-2.2	-3.2	3.1	4.0	4.5	0.3	2.1	4.1	-2.3	6.4	0.1
3.150	-1.4	-2.1	4.1	3.1	4.9	-5.0	-0.2	1.5	-0.6	4.0	-0.4
4.000	-2.3	-0.2	2.7	3.1	5.7	-5.6	-1.6	2.0	-0.1	-5.1	-0.5

Table A-3.8

Results for Measurements Over Grass, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 49

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	84.8	79.0	72.3	66.4	66.0	66.4	63.5	60.9	60.2	55.8	97.3
0.063	88.4	83.1	76.7	71.0	70.3	70.1	67.6	65.2	64.0	62.4	101.4
0.080	95.5	89.9	83.3	77.7	76.9	76.2	73.6	71.3	69.3	66.0	106.3
0.100	96.7	91.0	84.1	78.4	77.4	76.1	74.6	71.1	68.6	64.6	105.6
0.125	96.5	91.1	84.5	78.5	77.1	75.5	73.7	69.6	66.4	61.9	111.4
0.160	98.8	94.3	87.5	80.0	78.5	76.6	73.8	69.1	66.9	59.3	110.8
0.200	96.9	93.1	86.0	77.6	75.8	74.7	70.6	63.9	64.1	49.5	113.2
0.250	90.2	89.6	83.4	73.1	68.4	71.8	60.7	54.9	60.8	38.8	111.3
0.315	82.2	83.2	76.3	60.4	53.4	73.1	48.3	44.2	61.1	*******	105.7
0.400	83.5	76.9	66.5	56.9	51.8	75.0	48.6	40.9	63.1	*******	107.2
0.500	93.1	77.6	65.0	50.0	51.2	73.4	40.2	39.4	60.7	31.4	109.6
0.630	102.6	89.4	76.3	54.3	61.6	79.6	50.2	44.9	65.1	40.0	115.7
0.800	100.6	94.4	80.6	50.0	57.4	85.2	51.3	48.0	68.0	45.5	115.1
1.000	95.7	98.1	83.0	51.7	63.0	82.8	55.5	52.7	76.2	47.2	113.8
1.250	99.1	96.0	85.6	53.2	66.9	74.[illegible]	54.5	51.1	70.3	47.0	111.6
1.600	94.9	91.7	81.8	48.0	56.1	79.8	52.0	49.2	61.0	44.7	110.7
2.000	96.2	83.6	80.2	47.6	57.3	74.6	52.2	46.1	68.2	41.3	111.0
2.500	95.2	90.6	83.9	48.4	60.6	76.6	51.1	44.7	58.6	42.4	110.3
3.150	95.1	92.4	81.4	45.0	53.4	74.2	48.6	46.0	56.7	44.1	109.1
4.000	94.7	85.5	75.9	42.5	53.1	71.0	45.8	38.6	52.9	48.0	108.4
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 49

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.0	-4.1	-3.4	-3.6	-3.1	-3.6	-4.2	-4.1	-3.4	-2.6	-1.4
0.063	-2.2	-2.9	-2.5	-2.8	-2.1	-1.9	-2.9	-3.0	-1.8	-3.8	-0.1
0.080	-4.5	-4.9	-4.3	-4.7	-3.9	-3.2	-4.1	-4.4	-2.4	-2.6	-0.2
0.100	-3.9	-4.2	-3.3	-3.6	-2.6	-1.3	-3.4	-2.4	0.1	0.6	2.3
0.125	-1.9	-2.5	-1.9	-2.0	-0.6	1.0	-0.7	0.8	4.0	4.9	-1.7
0.160	-1.3	-2.8	-2.0	-0.6	0.9	2.8	2.0	4.1	6.5	10.3	1.8
0.200	0.8	-1.4	-0.3	1.9	3.7	4.8	5.3	9.4	9.3	20.1	-0.4
0.250	5.3	-0.1	0.0	4.2	8.9	5.5	12.9	16.1	10.2	28.4	-0.7
0.315	8.8	1.8	2.6	12.3	19.3	-0.4	20.7	22.1	5.2	*******	0.4
0.400	7.8	8.3	12.6	16.0	21.1	-2.1	20.5	25.5	3.3	*******	-0.8
0.500	1.3	10.7	17.2	25.9	24.7	2.5	31.9	29.9	8.6	33.8	-0.1
0.630	-1.8	5.4	12.3	28.0	20.7	2.7	28.2	30.7	10.5	31.4	0.3
0.800	-0.4	-0.2	7.4	31.5	24.1	-3.7	26.3	26.6	6.7	24.9	0.3
1.000	3.1	-5.4	3.5	28.3	16.9	-2.9	20.5	20.2	-3.3	21.1	0.2
1.250	-2.4	-5.4	-1.4	24.4	10.7	3.2	18.9	19.2	-0.0	18.5	0.3
1.600	0.7	-2.2	1.2	28.2	20.1	-3.6	19.9	19.3	7.5	18.6	0.2
2.000	-0.4	5.9	2.7	28.2	18.5	1.2	19.0	21.4	-0.7	20.3	0.1
2.500	-0.1	-1.9	-2.0	25.9	13.6	-2.4	17.9	20.2	6.4	15.7	0.2
3.150	-1.3	-5.1	-1.3	26.6	18.3	-2.6	17.2	14.8	4.1	9.4	0.3
4.000	-2.1	0.2	2.0	25.8	15.2	-2.7	15.4	16.5	2.3	-3.5	-0.0

Table A-4.1

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 11

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	97.5	92.3	76.3	74.2	73.3	63.3	72.4	70.3	59.6	65.3	100.0
0.063	93.0	93.0	82.3	80.7	79.6	71.8	77.8	75.5	60.5	63.4	104.2
0.080	93.3	93.5	88.0	86.9	85.5	73.2	82.2	77.5	62.8	72.2	108.5
0.100	93.6	93.6	89.4	86.4	84.5	65.5	79.8	73.6	59.8	64.7	105.6
0.125	97.0	92.7	87.1	81.0	78.9	59.9	72.3	64.2	55.3	48.4	104.0
0.160	104.1	100.1	94.1	86.0	83.3	68.6	74.6	64.1	60.2	50.7	111.6
0.200	101.5	96.1	88.3	75.3	72.3	65.1	59.9	53.5	54.1	63.7	115.1
0.250	95.7	83.3	79.6	69.1	57.8	72.9	54.5	54.0	59.4	54.2	114.5
0.315	86.7	80.7	66.4	73.8	69.5	72.0	63.1	57.8	65.3	65.0	111.3
0.400	79.6	80.7	76.6	77.3	77.3	73.4	69.1	68.6	66.8	65.8	106.6
0.500	91.0	84.4	80.2	72.0	74.3	68.9	72.0	67.3	58.7	68.6	112.1
0.630	93.1	89.3	76.3	70.3	75.3	77.0	72.6	74.4	66.7	70.5	117.0
0.800	102.6	96.3	87.1	79.3	84.3	75.7	80.0	70.7	67.0	67.1	116.0
1.000	102.3	97.0	91.0	75.1	77.6	75.7	75.6	68.2	69.0	65.6	114.7
1.250	93.5	89.7	85.2	73.7	75.0	74.9	73.6	71.5	65.9	68.3	112.3
1.600	97.5	90.0	82.8	75.4	76.8	70.7	72.5	63.7	59.7	61.5	112.1
2.000	93.6	92.1	76.6	73.2	71.5	73.0	67.7	63.9	58.3	60.0	111.9
2.500	95.8	87.4	78.2	72.4	69.5	69.0	63.8	56.9	55.3	53.6	111.5
3.150	94.1	83.5	75.5	67.6	67.4	67.2	59.3	54.9	49.3	53.5	110.9
4.000	95.4	85.3	75.2	63.5	60.2	62.1	56.2	52.9	37.5	58.6	109.2
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 11

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.8	-5.6	-5.6	-9.6	-9.7	-3.7	-11.3	-11.7	0.0	-10.2	-2.3
0.063	-5.2	-6.2	-6.6	-11.0	-9.9	-2.1	-11.6	-11.9	3.1	-8.2	-1.4
0.080	-6.7	-7.9	-8.5	-13.4	-12.0	0.3	-12.2	-10.1	4.7	-9.4	-1.9
0.100	-4.6	-5.6	-6.5	-10.5	-9.6	10.4	-7.5	-3.3	10.0	1.6	3.4
0.125	-1.2	-2.9	-3.4	-3.3	-1.2	17.8	1.8	7.4	16.2	19.5	6.9
0.160	-5.7	-7.8	-7.8	-5.8	-3.1	11.6	2.0	10.0	13.9	3.3	1.8
0.200	-2.5	-3.2	-1.4	5.5	3.5	15.7	17.3	21.1	20.5	7.3	-1.1
0.250	1.3	2.6	5.3	9.6	21.0	5.9	20.6	13.5	13.2	14.6	-2.5
0.315	5.3	5.2	13.5	-0.1	4.2	1.7	7.0	9.6	2.1	-1.4	-4.3
0.400	12.8	5.6	3.6	-3.3	-3.3	0.6	1.3	-0.9	0.9	-2.0	0.9
0.500	4.9	5.4	3.5	5.5	2.7	3.6	1.8	3.3	12.4	-1.4	-1.2
0.630	3.6	5.9	12.6	12.9	7.9	6.2	6.8	2.3	10.0	2.2	-0.3
0.800	-1.3	-1.1	2.0	3.0	-2.0	7.1	-1.1	5.4	9.2	4.9	0.4
1.000	-2.7	-3.5	-3.7	5.8	3.3	5.2	1.4	5.9	5.1	4.2	0.0
1.250	4.6	2.2	0.5	5.4	4.1	4.2	1.5	0.6	6.1	-1.3	0.4
1.600	0.1	1.3	2.2	2.8	1.4	7.5	1.4	7.0	11.0	4.2	0.6
2.000	-1.9	-1.7	7.2	3.5	5.2	3.9	4.5	4.7	10.3	2.9	0.0
2.500	0.7	2.6	5.0	3.2	6.1	6.6	6.7	9.5	11.1	6.1	0.3
3.150	1.2	0.2	6.0	5.4	5.6	5.9	7.8	7.3	12.9	0.3	-9.1
4.000	-1.4	1.3	4.0	6.0	9.4	7.4	6.1	3.3	13.6	-13.3	0.6

Table A-4.2

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 15

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.6	92.0	76.4	73.3	72.6	63.9	71.2	69.7	64.9	65.9	99.2
0.063	92.7	93.1	83.0	80.2	79.2	73.3	75.3	75.5	67.1	69.7	103.3
0.080	97.9	93.4	83.3	86.1	84.9	74.3	81.5	79.7	67.9	72.0	103.1
0.100	97.9	93.6	83.7	85.7	84.0	69.2	79.3	73.6	62.5	65.7	105.2
0.125	96.0	91.3	87.0	80.7	73.5	59.3	71.3	64.4	55.3	49.9	102.7
0.160	103.6	100.1	94.4	85.3	82.6	68.9	73.5	62.0	62.1	44.3	110.7
0.200	100.8	96.1	83.3	75.6	71.3	63.5	59.3	44.7	53.5	•••••••	114.5
0.250	95.1	83.3	79.2	65.5	56.5	74.2	43.1	[illegible].3	71.0	53.3	113.3
0.315	86.7	80.1	67.2	71.9	63.3	74.6	62.2	63.6	66.3	53.3	110.9
0.400	79.0	77.6	72.3	76.3	77.4	75.6	70.7	65.0	63.9	59.7	106.1
0.500	89.9	83.0	79.2	75.9	79.4	71.1	70.7	67.0	67.3	61.3	112.5
0.630	93.2	99.5	81.9	76.9	81.3	76.3	75.3	70.3	70.2	67.9	117.0
0.800	103.1	96.5	82.0	74.0	73.7	74.2	79.0	63.0	67.7	62.2	115.7
1.000	101.5	96.2	83.9	75.0	75.1	77.2	69.3	63.2	73.0	53.7	114.2
1.250	94.0	97.5	86.4	78.0	79.7	75.9	72.4	69.1	70.5	63.4	112.3
1.600	93.0	96.5	97.2	77.5	77.3	72.2	69.0	62.2	67.0	56.9	111.3
2.000	93.6	93.3	85.7	74.2	71.5	73.0	67.0	61.7	64.5	54.9	111.3
2.500	97.4	92.4	90.1	74.9	74.4	71.4	62.3	57.2	59.3	43.2	111.3
3.150	93.4	91.0	83.4	63.3	66.5	67.9	58.3	50.5	53.3	•••••••	110.3
4.000	97.3	86.3	75.4	62.4	60.3	60.3	50.1	39.2	42.5	•••••••	109.1
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 15

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.2	-5.6	-6.0	-9.0	-9.3	-4.6	-10.4	-11.4	-6.5	-11.1	-1.9
0.063	-6.1	-7.5	-9.5	-11.7	-10.7	-4.3	-11.3	-13.0	-4.6	-10.7	-2.2
0.080	-6.6	-9.2	-9.2	-13.0	-11.9	-1.7	-11.9	-11.7	-0.7	-9.5	-1.9
0.100	-4.1	-5.8	-7.0	-10.0	-9.3	6.5	-7.2	-4.0	7.1	0.3	3.6
0.125	-0.9	-2.9	-4.0	-3.7	-1.5	17.2	2.1	6.5	14.9	19.3	7.4
0.160	-5.6	-9.2	-9.5	-6.0	-2.9	10.9	2.7	11.6	11.6	25.2	2.3
0.200	-2.2	-3.6	-2.3	4.8	9.6	16.9	17.0	29.5	15.6	•••••••	-0.9
0.250	0.9	1.6	4.5	12.2	21.2	3.5	25.9	20.6	0.4	13.9	-2.3
0.315	4.4	4.9	11.7	0.9	4.4	-1.9	6.9	2.9	-0.4	9.9	-4.7
0.400	13.2	9.5	7.2	-2.5	-3.6	-1.3	-0.7	2.3	-1.6	3.3	1.1
0.500	5.3	6.0	3.6	0.7	-2.9	5.5	2.1	3.1	2.3	4.3	-2.4
0.630	3.0	5.6	7.1	5.9	0.9	5.9	2.6	5.9	5.9	4.1	-0.7
0.800	-2.2	-1.7	6.6	9.2	3.5	9.0	-0.6	7.5	7.3	9.1	0.3
1.000	-2.3	-3.1	-2.0	5.4	5.3	3.2	7.1	5.3	0.5	10.3	0.1
1.250	3.5	3.9	-1.4	0.4	-1.3	2.5	1.9	2.2	0.3	3.1	0.3
1.600	-1.3	-6.0	-3.1	-0.2	-0.5	5.1	4.0	7.6	2.9	7.9	0.1
2.000	-2.4	-3.9	-2.4	2.0	4.7	3.2	4.6	6.3	3.5	7.5	-0.4
2.500	-1.7	-3.1	-7.6	-0.0	0.5	3.5	7.5	3.5	5.9	15.2	-0.3
3.150	-3.7	-2.9	-2.5	3.9	6.1	4.3	9.4	11.4	3.0	•••••••	-0.1
4.000	-4.5	0.2	3.3	6.7	9.3	9.3	12.0	16.3	13.5	•••••••	0.0

Table A-4.3

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 19

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	87.0	82.4	76.9	73.9	73.1	69.5	71.7	69.9	64.1	65.9	99.7
0.063	92.3	87.8	82.7	79.8	78.7	72.7	76.5	75.0	64.8	69.1	103.4
0.080	97.6	93.1	88.0	85.7	84.4	74.5	80.8	77.1	64.2	70.3	107.8
0.100	98.3	93.9	88.6	86.2	84.2	67.2	80.1	74.1	63.3	65.2	105.2
0.125	96.3	92.1	86.9	80.9	78.6	61.0	71.9	64.6	58.0	50.0	102.9
0.160	104.0	100.2	93.9	84.9	81.6	70.8	73.9	63.1	66.0	49.3	111.0
0.200	100.7	95.8	88.2	73.8	70.3	64.2	57.1	44.0	58.6	33.5	114.2
0.250	95.2	88.5	78.9	65.1	70.0	74.9	48.8	53.1	70.6	58.0	113.8
0.315	85.7	80.2	66.1	67.5	63.7	76.9	62.9	65.6	68.5	59.9	110.8
0.400	82.7	79.6	71.5	74.3	75.5	78.6	74.1	70.6	69.5	69.6	106.1
0.500	91.5	84.9	78.6	75.4	78.8	75.6	72.4	70.3	69.1	65.5	112.5
0.630	99.5	91.5	85.3	69.8	77.7	82.0	76.2	73.3	74.5	71.0	117.0
0.800	103.4	97.6	89.1	77.0	79.3	78.4	77.9	62.2	69.9	67.3	115.5
1.000	103.3	97.7	87.7	76.3	78.1	75.5	71.2	69.5	74.1	64.0	114.5
1.250	97.3	92.0	84.2	80.2	79.5	74.9	71.7	65.6	73.1	67.1	112.4
1.600	97.0	92.6	82.6	80.1	81.1	73.5	70.4	69.2	69.8	64.6	111.7
2.000	98.1	92.4	79.4	76.1	71.6	71.3	63.6	63.3	64.4	56.5	111.3
2.500	96.9	88.3	77.2	74.6	73.7	69.8	61.6	57.2	57.0	45.0	111.2
3.150	96.1	87.9	75.2	68.7	65.7	68.5	59.6	50.3	53.8	43.2	109.9
4.000	95.6	87.3	72.9	67.7	64.4	62.5	54.7	42.8	44.6	43.4	108.9
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**2.5**

(b) Excess Attenuation, dB

RUN 19

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.6	-7.0	-7.5	-10.6	-9.8	-6.2	-11.9	-12.6	-6.8	-12.1	-3.3
0.063	-6.6	-8.1	-9.1	-12.2	-11.1	-5.1	-12.4	-13.4	-3.2	-11.0	-2.7
0.080	-6.8	-8.3	-9.3	-13.0	-11.7	-1.8	-11.6	-10.5	2.5	-7.2	-2.0
0.100	-5.4	-7.0	-7.8	-11.4	-9.4	7.6	-8.9	-5.4	5.4	-0.1	2.7
0.125	-1.7	-3.5	-4.4	-4.4	-2.1	15.5	1.0	5.8	12.3	16.7	6.7
0.160	-6.3	-8.6	-8.3	-5.4	-2.1	8.7	2.0	10.3	7.4	20.4	1.7
0.200	-2.6	-3.8	-2.2	6.1	9.6	15.7	19.2	29.7	15.0	36.4	-1.1
0.250	1.0	1.6	5.1	12.8	7.9	3.0	25.4	18.5	1.1	9.9	-2.6
0.315	5.5	4.9	12.9	5.3	9.2	-4.1	6.3	0.9	-2.0	2.8	-4.6
0.400	9.4	6.4	8.4	-0.6	-1.8	-4.9	-4.1	-3.3	-2.2	-6.2	1.0
0.500	3.6	4.1	4.2	1.2	-2.2	1.0	0.4	-0.2	1.0	0.7	-2.4
0.630	1.5	3.4	3.5	12.7	4.8	0.5	2.5	2.6	1.4	0.9	-0.9
0.800	-2.8	-3.1	-0.8	5.0	2.7	3.6	0.2	13.1	5.4	3.8	0.1
1.000	-4.2	-4.7	-0.9	4.0	2.2	4.8	5.2	4.0	-0.6	5.0	-0.3
1.250	0.4	-0.5	1.0	-1.5	-0.8	3.8	2.9	5.9	-1.6	-0.2	0.4
1.600	-0.0	-1.9	1.7	-2.5	-3.5	4.1	2.9	0.9	0.3	0.5	0.4
2.000	-1.9	-2.5	3.9	0.2	4.7	5.0	8.1	4.8	3.7	6.0	0.1
2.500	-1.4	0.8	5.1	0.1	1.0	4.9	8.1	8.4	8.6	14.0	-0.4
3.150	-1.7	-0.1	5.5	3.6	6.6	3.8	6.9	11.4	7.9	10.4	0.0
4.000	-2.2	-0.8	5.8	1.5	4.8	6.7	7.5	13.4	11.6	2.2	0.2

Table A-4.4

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 27

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.8	79.5	74.9	70.7	70.2	69.4	67.9	65.7	63.3	61.7	98.3
0.063	91.2	85.9	80.6	76.6	76.0	73.1	73.7	71.9	67.5	67.3	102.0
0.080	97.4	92.5	87.4	84.2	83.4	77.2	80.0	77.7	70.2	71.4	107.4
0.100	97.8	92.9	87.8	84.2	83.0	74.1	79.0	74.1	61.3	64.6	104.3
0.125	95.7	91.0	85.9	80.1	78.8	66.8	71.0	64.7	56.2	54.0	102.8
0.160	103.2	98.9	93.3	84.3	82.0	72.8	71.6	65.2	64.4	47.9	111.4
0.200	100.1	95.1	88.3	72.6	70.4	65.9	61.8	39.2	55.8	34.0	114.2
0.250	93.7	87.7	78.2	59.9	54.1	68.4	46.0	38.8	61.9	32.9	113.8
0.315	83.8	78.2	63.7	57.0	51.9	72.2	46.9	46.4	65.5	41.1	110.3
0.400	79.1	72.3	64.0	62.6	63.1	74.4	59.9	57.9	65.5	47.6	106.2
0.500	88.6	79.4	73.6	67.4	71.5	74.8	67.0	64.6	64.2	47.3	111.5
0.630	97.9	88.8	81.3	72.8	78.2	75.6	71.5	64.8	70.7	57.0	116.6
0.800	101.2	94.7	87.5	72.9	79.7	73.3	71.7	67.6	65.7	59.4	115.6
1.000	100.3	95.8	85.8	72.9	75.3	84.5	76.1	68.7	75.9	70.1	114.2
1.250	92.5	92.0	79.9	72.3	75.3	80.8	71.3	64.5	73.1	59.5	112.2
1.600	95.8	86.2	82.5	73.1	74.8	78.8	62.4	64.0	69.1	56.8	111.8
2.000	96.2	90.7	76.2	76.6	74.8	74.2	66.7	57.9	63.5	54.6	111.6
2.500	92.3	88.9	76.8	72.0	70.5	74.6	62.8	57.8	60.3	47.5	110.9
3.150	93.8	88.2	76.5	65.4	63.6	72.2	58.2	53.5	55.5	42.5	110.2
4.000	95.5	83.8	72.4	62.7	60.3	69.9	51.5	45.1	50.4	43.4	109.3
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**2.5**

(b) Excess Attenuation, dB

RUN 27

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.9	-3.6	-5.0	-6.9	-6.4	-11.6	-7.6	-7.9	-5.5	-7.5	-1.4
0.063	-4.5	-5.2	-6.0	-8.0	-7.4	-10.5	-8.6	-9.3	-4.9	-8.3	-0.3
0.080	-6.4	-7.5	-8.5	-11.3	-10.5	-10.4	-10.6	-10.9	-3.4	-8.1	-1.4
0.100	-4.3	-5.4	-6.4	-8.8	-7.6	-4.8	-7.2	-4.8	8.0	1.1	4.2
0.125	-1.0	-2.4	-3.3	-3.6	-2.3	3.6	2.0	5.7	14.2	12.8	6.9
0.160	-5.3	-7.0	-7.5	-4.6	-2.3	0.7	4.5	8.3	9.1	22.0	1.5
0.200	-2.2	-3.3	-2.5	7.0	9.2	7.5	14.6	34.2	17.7	35.7	-1.3
0.250	2.0	1.9	5.3	17.5	23.3	2.7	27.7	32.7	9.2	34.4	-3.1
0.315	7.8	7.3	15.7	16.2	21.3	-5.4	22.5	20.4	1.3	21.9	-3.7
0.400	12.7	13.4	15.5	10.7	10.2	-7.6	9.7	8.9	1.3	15.3	0.6
0.500	6.3	9.4	9.1	9.0	4.9	-5.0	5.6	5.2	5.6	18.4	-1.5
0.630	3.2	6.2	7.5	9.7	4.3	0.2	7.1	11.0	5.1	14.7	-0.4
0.800	-0.5	-0.1	0.9	9.1	2.3	1.9	6.3	7.6	9.5	11.4	0.2
1.000	-1.0	-2.7	1.1	7.5	5.1	-11.1	0.3	4.7	-2.5	-1.2	0.2
1.250	4.9	-0.8	5.0	5.9	2.9	-9.9	2.8	6.4	-2.2	6.7	0.3
1.600	0.7	4.1	1.4	3.9	2.2	-9.5	10.3	5.3	0.2	7.3	-0.1
2.000	0.1	-0.8	7.2	-0.4	1.4	-6.4	4.8	10.0	4.4	7.4	-0.1
2.500	3.2	0.1	5.4	2.5	4.0	-9.4	6.5	7.4	4.9	10.8	-0.1
3.150	0.8	-0.2	4.2	6.8	8.6	-10.9	9.1	7.8	5.8	10.4	-0.1
4.000	-2.0	2.8	6.3	6.3	8.7	-14.3	10.3	10.5	5.2	1.3	0.0

Table A-4.5

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 31

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.3	81.6	75.9	72.0	71.5	69.1	70.1	68.7	65.2	66.3	89.2
0.063	92.2	87.1	81.8	77.9	77.3	73.4	75.6	74.7	68.6	71.2	103.3
0.080	97.2	92.3	86.9	83.5	82.3	77.0	80.7	78.4	68.5	71.8	106.6
0.100	98.1	98.2	88.0	84.4	83.3	75.1	80.7	75.5	58.3	63.3	103.1
0.125	95.3	91.3	86.2	80.7	79.4	67.1	72.5	64.7	62.7	57.3	105.4
0.160	103.0	98.7	93.2	85.1	82.3	71.6	70.1	68.0	71.3	59.1	113.0
0.200	99.9	94.3	88.0	72.3	70.1	64.7	62.1	49.3	63.5	46.0	115.0
0.250	93.6	87.6	77.3	59.5	52.2	70.7	51.9	53.4	69.3	51.9	113.7
0.315	84.6	78.7	63.6	60.0	54.9	74.2	54.0	58.5	67.3	56.1	109.6
0.400	76.3	71.9	61.1	59.2	60.0	76.0	64.5	67.2	66.3	61.9	109.1
0.500	89.0	79.1	69.7	63.6	68.4	75.7	71.7	71.3	68.2	65.3	110.2
0.630	98.7	88.7	79.7	74.0	78.6	76.4	77.4	74.5	73.1	72.4	116.6
0.800	102.4	94.9	87.1	78.9	84.1	80.3	75.6	77.1	75.1	73.5	116.4
1.000	103.2	98.5	90.6	72.7	76.5	84.6	71.5	80.3	72.5	68.6	114.4
1.250	97.5	96.9	86.3	76.1	81.0	78.0	69.4	72.4	74.1	69.0	112.7
1.600	95.7	83.3	76.7	79.0	80.1	74.3	69.6	70.4	72.3	63.9	112.0
2.000	95.5	90.2	79.3	75.5	71.9	78.2	69.5	67.2	67.5	61.4	112.0
2.500	99.3	85.9	78.9	73.3	74.4	69.4	74.9	64.9	63.7	55.6	111.6
3.150	95.5	85.4	73.3	63.7	69.1	68.3	67.3	56.7	58.7	50.3	110.5
4.000	94.2	83.9	71.4	69.3	64.3	63.3	53.3	50.0	50.8	46.4	109.5
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 31

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.9	-5.7	-6.0	-8.2	-7.7	-5.3	-9.3	-10.9	-7.4	-12.1	-2.3
0.063	-5.2	-6.1	-6.9	-9.0	-8.4	-4.5	-10.2	-11.8	-5.7	-11.8	-1.0
0.080	-5.9	-7.0	-7.7	-10.3	-9.6	-3.8	-11.0	-11.3	-1.3	-8.2	-0.3
0.100	-4.3	-5.9	-6.8	-9.2	-8.1	0.1	-9.1	-6.4	10.8	2.3	5.2
0.125	-0.6	-2.1	-3.1	-3.6	-2.3	10.0	1.0	6.3	8.3	10.0	-4.3
0.160	-5.0	-6.8	-7.3	-5.3	-3.0	8.2	6.1	5.7	2.4	11.0	0.0
0.200	-1.7	-2.7	-1.9	7.7	9.9	15.3	14.3	24.5	10.3	24.1	-1.3
0.250	2.2	2.1	5.8	18.0	25.3	6.8	22.0	17.9	2.0	15.6	-2.9
0.315	6.3	6.6	15.6	13.0	18.1	-1.2	15.4	3.2	-1.1	6.8	-3.2
0.400	15.7	14.0	13.7	14.4	13.6	-2.4	5.3	-0.1	0.3	1.3	-2.1
0.500	6.5	10.3	13.5	13.4	8.6	1.3	1.5	-0.8	2.3	1.2	0.3
0.630	2.8	6.7	9.6	9.0	4.4	6.6	1.8	1.9	3.3	-0.1	0.0
0.800	-1.6	-0.2	1.4	3.3	-1.9	1.9	2.7	-1.7	0.3	-2.3	-0.5
1.000	-4.0	-5.4	-3.8	7.7	3.9	-4.2	4.9	-6.8	1.0	0.5	-0.1
1.250	-0.0	-5.6	-1.3	2.4	-2.5	0.5	5.0	-1.1	-2.8	-2.3	-0.1
1.600	1.0	6.6	7.4	-1.7	-2.8	2.5	3.4	-0.6	-2.5	0.9	-0.2
2.000	0.9	-0.1	3.8	1.0	4.6	-1.7	2.5	1.3	1.0	1.5	-0.4
2.500	-3.2	3.8	4.1	2.2	1.1	6.1	-4.4	1.6	2.8	4.5	-0.2
3.150	-1.2	1.3	6.8	3.7	3.3	4.1	-1.1	5.3	3.3	3.8	-0.3
4.000	-1.2	2.3	7.1	-0.0	5.0	5.5	3.7	6.7	5.9	0.2	-0.3

Table A-4.6

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 34

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	82.4	81.3	76.5	73.7	72.9	70.0	72.3	70.7	64.2	65.3	99.5
0.063	92.5	87.3	82.7	80.1	79.0	73.5	77.3	76.2	64.6	67.6	103.7
0.080	97.6	93.0	87.9	85.6	84.5	75.3	81.7	76.7	66.9	71.4	107.7
0.100	97.7	93.0	83.2	85.1	83.4	69.1	73.7	71.4	64.1	61.9	104.1
0.125	96.0	91.3	86.3	79.7	77.9	61.0	70.9	63.2	62.1	51.4	103.7
0.160	103.5	99.6	93.3	93.5	80.3	69.7	71.7	63.3	67.4	54.3	111.7
0.200	100.4	95.2	87.9	73.1	69.3	63.2	53.1	47.1	61.2	53.7	114.5
0.250	93.2	86.7	73.1	64.2	54.4	73.3	43.2	57.9	71.9	61.6	113.3
0.315	82.9	79.7	67.5	67.3	65.1	76.2	65.6	67.3	75.1	64.3	110.5
0.400	83.9	73.5	76.6	73.3	74.9	75.7	71.4	63.3	75.2	59.2	106.7
0.500	90.7	83.3	79.3	71.1	74.0	70.2	67.4	69.9	70.1	71.2	111.5
0.630	97.3	87.9	81.1	71.1	74.7	73.3	75.4	71.1	77.0	70.3	116.3
0.800	100.1	90.3	84.2	79.7	81.4	79.4	74.9	69.3	71.7	67.4	116.0
1.000	97.4	87.1	86.1	73.4	76.5	75.5	73.3	71.3	73.9	63.0	114.4
1.250	90.6	87.2	79.9	77.3	80.5	73.5	75.1	67.3	70.3	63.2	112.9
1.600	93.0	83.3	82.3	77.6	73.4	72.4	63.7	61.1	73.9	59.3	111.9
2.000	93.2	89.3	75.7	72.5	72.3	71.6	63.0	63.6	71.4	56.9	111.9
2.500	97.9	90.3	73.3	74.5	69.7	71.3	64.3	60.2	65.1	51.5	111.5
3.150	95.1	86.4	75.1	69.0	65.3	70.7	60.5	54.6	57.9	45.3	110.4
4.000	95.6	85.3	73.0	69.1	62.1	65.0	54.9	53.3	51.7	45.6	109.3
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**2.5**

(b) Excess Attenuation, dB

RUN 34

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-0.5	-5.9	-6.6	-9.9	-9.1	-6.2	-12.0	-12.9	-6.4	-11.0	-2.6
0.063	-5.5	-6.3	-7.3	-11.2	-10.1	-4.6	-12.4	-13.3	-1.7	-3.3	-1.7
0.080	-6.3	-7.7	-3.7	-12.4	-11.3	-2.1	-12.0	-9.5	0.3	-7.3	-1.4
0.100	-4.4	-5.7	-7.0	-9.9	-3.2	6.1	-7.1	-2.3	5.0	3.6	4.2
0.125	-0.3	-2.6	-3.7	-2.6	-0.3	16.1	2.6	7.3	3.9	16.0	6.5
0.160	-5.5	-7.7	-7.9	-3.7	-1.0	10.1	4.5	10.4	6.3	15.3	1.3
0.200	-2.2	-3.1	-1.3	6.9	10.7	16.3	13.2	26.7	12.6	16.4	-1.3
0.250	2.6	3.0	5.5	13.3	23.1	3.7	25.6	13.4	-0.6	5.9	-3.0
0.315	3.5	5.6	11.7	5.2	7.9	-3.2	3.3	-1.1	-3.4	-1.9	-4.1
0.400	3.1	7.4	3.2	-0.2	-1.3	-2.1	-1.6	-1.1	-3.0	4.0	0.3
0.500	4.3	5.6	3.4	5.9	3.0	6.3	5.3	0.6	0.4	-4.7	-1.0
0.630	3.7	7.5	3.2	11.9	3.3	4.2	3.3	5.3	-0.6	1.5	-0.2
0.800	0.7	4.4	4.3	2.5	0.3	2.3	3.4	5.6	3.7	3.3	-0.1
1.000	1.3	6.0	0.7	2.0	3.9	4.9	2.6	1.7	-5.4	1.1	-0.1
1.250	6.9	4.1	5.1	0.7	-2.0	-0.0	-0.7	3.6	1.1	-1.5	-0.3
1.600	-1.3	1.6	1.3	-0.3	-1.1	4.9	4.4	3.3	-4.1	5.1	-0.1
2.000	3.2	0.3	7.9	4.1	4.3	5.0	4.1	5.0	-2.3	6.1	-0.3
2.500	-1.3	-1.1	4.2	1.0	5.3	4.2	6.3	6.4	1.5	3.7	-0.1
3.150	-0.3	1.3	5.5	3.5	7.2	1.3	6.4	7.7	4.4	3.7	-0.7
4.000	-2.5	0.9	5.6	0.3	7.3	4.4	7.3	3.3	5.4	1.5	-0.6

Table A-4.7

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 37

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	87.5	82.4	76.9	64.5	73.5	70.2	72.2	70.8	65.1	65.6	98.9
0.063	98.4	88.3	83.1	71.0	79.3	74.0	77.3	76.2	66.8	67.2	103.3
0.080	97.7	92.7	87.5	75.6	84.2	75.3	81.1	77.6	64.6	69.9	106.4
0.100	98.1	98.0	88.1	75.8	83.8	69.1	79.0	73.1	62.3	64.2	102.3
0.125	97.3	92.8	87.9	72.5	79.7	63.0	72.6	65.3	62.9	52.8	104.6
0.160	103.8	99.4	93.9	74.9	81.4	71.3	74.4	61.6	70.4	55.6	111.1
0.200	101.1	95.9	88.8	64.3	72.2	67.3	59.9	49.0	65.0	54.8	114.3
0.250	98.8	88.0	77.5	58.3	57.5	74.8	56.5	54.5	65.9	60.9	112.9
0.315	84.0	77.8	64.6	61.8	67.0	77.4	65.1	62.2	74.6	59.8	109.6
0.400	80.4	72.0	68.5	66.3	76.4	80.1	72.0	68.0	73.9	67.7	106.6
0.500	89.5	80.3	77.4	64.4	76.4	74.5	72.6	66.3	70.7	67.6	110.8
0.630	98.0	88.8	84.0	61.6	78.0	75.4	77.5	74.8	71.9	73.6	116.6
0.800	101.9	95.5	88.7	65.5	83.3	82.0	79.3	74.5	74.0	70.2	115.4
1.000	101.0	96.9	81.4	62.9	80.1	83.5	77.2	69.9	76.2	72.8	113.3
1.250	94.3	91.8	91.2	66.2	83.6	78.0	75.9	70.1	71.1	74.8	111.8
1.600	94.9	88.8	88.5	65.7	76.3	77.2	70.6	67.4	70.2	68.4	111.3
2.000	97.1	90.1	88.2	62.4	73.4	74.1	67.7	65.6	64.0	64.5	111.0
2.500	95.6	86.0	82.8	63.2	72.4	70.0	67.5	63.4	63.[illegible]	62.2	110.4
3.150	94.9	89.5	75.9	59.1	67.9	66.1	64.2	62.5	59.0	53.9	109.4
4.000	94.5	82.5	72.5	53.5	61.2	60.7	53.2	55.2	52.1	51.5	103.0
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 37

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.5	-6.4	-6.9	-0.6	-9.6	-6.3	-11.8	-12.9	-7.2	-11.2	-1.9
0.063	-6.3	-7.2	-8.1	-2.0	-10.8	-5.0	-12.3	-13.2	-3.8	-7.8	-1.2
0.080	-7.2	-8.2	-9.1	-3.2	-11.8	-2.9	-12.2	-11.2	1.8	-7.1	-0.9
0.100	-5.7	-6.6	-7.8	-1.5	-9.5	5.2	-8.3	-4.9	5.9	0.4	5.1
0.125	-3.1	-4.6	-5.8	3.6	-3.6	13.1	-0.1	4.7	7.1	13.5	4.6
0.160	-6.3	-8.0	-8.5	4.4	-2.1	7.5	1.4	11.6	2.8	13.9	1.4
0.200	-3.3	-4.2	-3.1	14.8	7.4	11.8	16.1	24.4	8.4	14.9	-1.5
0.250	1.7	1.4	5.9	18.9	19.7	2.4	17.1	16.5	5.1	6.4	-2.4
0.315	6.5	6.6	13.7	10.4	5.2	-5.2	3.4	3.7	-8.7	2.3	-4.1
0.400	10.3	13.1	10.5	6.5	-3.6	-7.3	-2.9	-1.6	-7.5	-5.1	-0.4
0.500	5.2	3.3	5.1	11.8	-0.2	1.7	-0.1	3.5	-0.9	-1.7	-1.1
0.630	2.7	5.8	4.4	20.5	4.1	6.7	0.9	0.8	3.7	-2.0	-0.9
0.800	-1.8	-1.5	-0.8	16.0	-1.8	-0.5	-2.1	0.4	0.9	0.6	-0.2
1.000	-2.5	-4.5	4.8	16.9	-0.3	-3.7	-1.3	3.1	-3.2	-4.1	0.3
1.250	2.4	-1.3	-6.9	11.6	-5.8	-0.2	-2.2	0.6	-0.4	-3.6	-0.0
1.600	0.9	5.8	-0.3	9.8	0.2	-0.7	1.7	1.7	-1.1	-4.1	-0.4
2.000	-1.6	-0.9	-0.5	13.4	2.4	1.7	3.6	2.3	3.9	-2.1	-0.3
2.500	-0.4	2.8	-0.7	11.5	2.3	4.7	2.3	2.6	2.7	-2.5	0.1
3.150	-1.1	-2.3	4.3	13.0	4.2	6.0	2.3	-0.5	3.0	0.4	-0.2
4.000	-2.4	2.7	5.2	15.1	7.3	7.9	3.7	1.1	4.2	-5.0	-0.3

Table A-4.8

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 41

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	37.5	32.2	77.3	75.0	74.1	70.6	73.3	71.3	65.5	64.1	93.9
0.063	92.3	37.5	33.0	30.9	79.3	74.0	77.9	75.6	63.0	63.5	102.6
0.080	97.7	92.3	37.4	36.0	34.3	75.2	31.3	76.1	71.6	72.2	106.0
0.100	93.1	92.6	33.0	35.9	34.1	69.7	79.0	72.1	71.6	62.3	101.6
0.125	96.3	91.3	36.6	32.1	79.6	65.5	69.1	71.0	63.5	56.9	105.1
0.160	104.1	93.9	93.4	36.3	33.0	75.9	72.3	71.3	74.1	60.4	112.5
0.200	100.9	95.6	33.3	73.4	71.9	69.7	67.1	54.5	67.6	50.3	114.7
0.250	94.4	33.9	79.1	67.7	57.5	73.7	64.3	51.4	71.0	57.3	113.4
0.315	35.0	79.5	66.1	69.3	62.7	77.3	66.6	57.3	75.4	60.9	103.0
0.400	75.2	63.9	61.2	74.3	73.9	77.7	75.4	63.7	76.6	63.6	107.3
0.500	39.3	77.9	70.3	75.4	73.3	71.4	71.9	69.0	75.4	64.9	109.3
0.630	93.6	37.6	79.3	76.9	33.7	73.0	72.5	79.0	75.5	63.9	115.3
0.800	102.5	94.6	37.1	79.4	33.9	31.0	74.5	79.3	72.5	69.5	115.3
1.000	103.3	93.5	91.2	74.3	36.0	33.9	33.6	79.9	73.4	72.4	113.5
1.250	96.3	95.1	30.4	79.7	37.0	79.7	77.3	79.2	74.3	72.6	111.7
1.600	93.9	34.5	30.6	67.9	72.4	77.3	76.3	75.4	71.3	66.7	111.0
2.000	99.4	90.0	35.5	71.4	63.9	77.1	73.3	73.3	65.7	60.6	111.0
2.500	92.9	90.3	73.1	75.7	71.3	70.3	64.9	67.5	63.7	56.7	110.9
3.150	97.1	90.5	79.3	74.3	74.2	70.9	63.3	59.5	61.3	53.7	109.3
4.000	94.5	36.5	72.1	59.4	65.4	67.3	60.7	56.0	56.5	51.5	103.2
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 41

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-6.2	-6.9	-3.0	-11.3	-10.9	-7.4	-13.6	-14.1	-3.3	-10.4	-2.6
0.063	-5.9	-6.6	-3.2	-12.1	-11.0	-5.2	-12.6	-12.3	-5.2	-9.3	-0.7
0.080	-7.3	-7.9	-9.1	-13.7	-12.5	-2.9	-12.5	-9.3	-5.3	-9.5	-0.6
0.100	-5.7	-6.2	-7.7	-11.6	-9.3	4.6	-9.3	-3.9	-3.4	2.3	5.3
0.125	-2.2	-3.2	-4.6	-6.1	-3.6	10.5	3.3	-1.1	1.4	9.3	4.0
0.160	-6.9	-7.3	-3.3	-7.3	-4.0	3.1	2.7	1.1	-1.2	3.3	-0.3
0.200	-3.3	-4.6	-3.9	5.5	7.0	9.2	3.2	13.2	5.1	13.7	-2.6
0.250	0.9	0.3	4.1	9.3	19.5	3.3	3.6	19.4	-0.2	9.3	-3.1
0.315	5.7	5.1	12.4	3.1	9.7	-4.9	2.2	3.3	-9.3	1.4	-2.3
0.400	16.3	16.5	13.1	-1.2	-0.3	-4.6	-5.9	3.1	-9.3	-0.6	-1.3
0.500	5.3	10.6	11.6	0.3	-2.6	4.3	0.6	0.3	-5.6	1.0	0.3
0.630	2.0	6.9	3.5	5.2	-1.6	4.1	5.3	-3.4	0.1	2.7	-0.2
0.800	-2.6	-0.3	0.6	2.0	-7.5	0.4	3.1	-5.0	2.3	1.2	-0.3
1.000	-5.0	-6.3	-5.2	5.3	-6.4	-4.3	-7.9	-7.0	-5.5	-3.3	-0.1
1.250	-0.3	-4.3	3.7	-2.1	-9.4	-2.1	-3.7	-3.6	-4.2	-6.5	-0.1
1.600	1.5	4.7	2.2	3.2	3.7	-1.2	-4.4	-6.6	-3.0	-2.3	-0.5
2.000	-4.0	-0.9	-2.9	4.2	6.7	-1.5	-2.1	-5.6	1.0	1.7	-0.4
2.500	2.4	-1.9	4.1	-1.0	2.9	3.9	4.9	-1.6	-2.3	2.3	-0.3
3.150	-3.6	-3.6	0.5	-3.2	-2.6	0.7	2.7	1.3	0.0	-0.2	-0.4
4.000	-2.6	-1.4	5.3	3.7	2.7	0.3	0.7	-0.4	-1.0	-6.0	-0.6

Table A-4.9

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 47

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC* 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.5	80.3	74.2	69.0	68.2	67.8		62.1	61.3	55.1	97.9
0.063	91.7	86.0	79.3	74.2	73.1	72.4		67.5	65.8	61.2	101.8
0.080	97.2	91.3	84.8	80.1	79.1	77.4		73.1	70.5	66.3	106.3
0.100	97.7	91.6	85.2	80.5	79.1	76.9		73.0	69.3	66.6	102.8
0.125	96.0	90.2	83.8	78.8	77.0	74.4		68.8	64.2	60.1	103.3
0.160	103.2	97.9	91.5	84.8	82.6	79.9		72.2	67.5	61.4	111.2
0.200	101.0	95.3	87.8	79.9	77.8	76.4		63.3	61.8	47.0	113.9
0.250	95.7	90.4	82.5	71.5	66.5	67.3		49.9	56.6	44.6	112.8
0.315	89.4	85.0	74.7	55.5	48.1	65.8		39.7	54.9	••••••	108.9
0.400	81.4	75.1	61.5	56.7	54.5	68.5		52.0	60.3	49.8	105.8
0.500	87.3	72.0	61.5	53.6	52.3	71.0		48.0	59.9	45.7	109.5
0.630	96.4	83.5	69.8	51.5	59.7	77.7		43.6	64.1	33.4	115.6
0.800	101.1	90.3	77.8	51.7	61.9	82.6		51.5	70.9	42.4	114.8
1.000	103.3	95.2	83.0	54.3	68.4	86.3		53.2	76.0	46.2	113.2
1.250	100.9	96.0	81.8	56.1	69.7	83.9		57.0	74.8	48.4	111.3
1.600	93.4	94.1	79.0	46.7	64.3	78.9		52.1	69.5	45.0	110.0
2.000	95.3	93.2	78.2	47.5	63.8	66.6		52.4	71.3	44.3	110.3
2.500	99.9	92.5	77.1	48.2	62.8	74.0		53.5	71.4	45.3	109.5
3.150	92.1	87.2	74.9	44.7	56.2	73.9		48.4	••••••	48.6	108.6
4.000	96.9	83.9	77.2	43.0	53.1	72.7		45.7	52.4	51.3	107.5
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 47

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC* 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.6	-5.9	-5.3	-6.2	-5.4	-5.0		-5.3	-4.5	-1.9	-2.0
0.063	-5.4	-5.7	-5.1	-6.0	-4.9	-4.2		-5.4	-3.6	-2.6	-0.5
0.080	-6.1	-6.2	-5.8	-7.1	-6.1	-4.4		-6.2	-3.6	-2.9	-0.2
0.100	-4.8	-4.7	-4.4	-5.7	-4.3	-2.1		-4.3	-0.6	-1.4	5.1
0.125	-1.3	-1.6	-1.2	-2.2	-0.4	2.2		1.6	6.3	6.8	6.4
0.160	-5.6	-6.4	-6.0	-5.4	-3.2	-0.5		1.1	5.8	9.3	1.4
0.200	-3.2	-3.6	-2.1	-0.3	1.8	3.2		10.1	11.5	22.6	-1.1
0.250	-0.1	-0.9	0.9	5.8	10.8	10.0		21.1	14.4	22.5	-2.2
0.315	1.7	-0.0	4.2	17.2	24.6	6.9		26.7	11.5	••••••	-2.8
0.400	10.0	10.2	17.6	16.2	18.4	4.4		14.4	6.1	12.7	0.6
0.500	7.1	16.3	20.7	22.3	23.6	4.9		21.3	9.4	19.6	0.0
0.630	4.5	11.3	18.8	30.8	22.6	4.6		31.9	11.5	38.0	0.4
0.800	-0.8	3.9	10.2	29.9	19.6	-1.1		23.2	3.8	28.0	0.6
1.000	-4.4	-2.5	3.5	25.7	11.6	-6.3		19.8	-3.0	22.3	0.8
1.250	-4.1	-5.4	2.5	21.5	7.9	-6.3		13.4	-4.4	17.2	0.6
1.600	2.3	-4.6	4.1	29.6	12.0	-2.6		16.6	-0.8	19.5	0.9
2.000	0.6	-3.6	4.8	28.4	12.1	9.3		15.3	-3.6	17.8	0.9
2.500	-4.7	-3.7	4.9	26.3	11.6	0.4		11.9	-6.0	13.5	1.0
3.150	1.8	0.2	5.3	27.3	15.8	-1.9		13.2	••••••	4.9	0.8
4.000	-4.2	2.0	1.0	25.9	15.8	-3.9		10.5	3.7	-5.3	0.9

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*Recorded signal quality not acceptable.

Table A-4.10

Results for Measurements Over Grass, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 48

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.4	79.6	73.2	67.2	66.5	67.0	64.3	62.0	61.1	58.0	97.9
0.063	90.0	84.5	78.2	71.7	71.1	71.0	68.5	66.2	64.6	63.2	101.4
0.080	96.3	91.1	84.3	78.9	78.1	77.5	75.2	73.0	71.2	69.5	107.2
0.100	96.9	91.1	84.5	78.8	77.7	76.4	74.8	71.7	70.0	67.4	103.4
0.125	95.6	90.1	83.9	77.4	75.9	74.6	73.0	68.5	66.2	62.0	103.9
0.160	102.3	97.0	90.5	83.2	81.3	80.6	78.6	73.5	70.2	64.7	111.1
0.200	100.6	95.1	88.0	79.7	77.5	78.3	73.3	66.1	66.0	53.7	114.5
0.250	95.7	90.6	83.1	71.8	67.2	69.5	58.3	51.4	58.7	40.0	113.7
0.315	89.6	85.3	75.3	57.0	49.3	67.4	42.2	41.2	58.3	◆◆◆◆◆◆◆	109.6
0.400	81.3	76.0	62.3	51.7	47.2	68.3	41.1	42.0	58.5	40.2	106.2
0.500	86.9	72.5	61.1	53.0	52.8	71.2	44.8	45.0	59.3	39.9	110.4
0.630	95.9	82.3	68.2	48.0	54.3	76.5	49.4	45.2	62.9	41.9	116.3
0.800	101.0	90.5	73.8	50.2	60.5	82.1	56.2	50.5	71.4	48.2	115.4
1.000	102.8	94.4	79.9	48.5	60.0	84.8	53.4	55.5	66.7	48.7	113.7
1.250	100.0	95.5	80.5	49.4	61.7	84.2	55.7	53.1	65.9	47.5	111.9
1.600	93.4	93.8	78.9	48.4	60.8	81.6	53.6	51.1	69.2	44.7	110.5
2.000	93.3	93.0	75.9	45.9	59.5	76.2	50.1	47.9	56.6	41.7	111.0
2.500	99.9	94.1	80.8	47.9	58.3	73.3	50.3	50.3	58.7	43.2	110.4
3.150	92.0	88.6	77.7	45.6	57.3	73.0	50.3	47.5	60.6	45.2	109.3
4.000	96.0	84.4	77.6	41.5	50.7	72.7	45.1	43.3	51.6	50.1	108.4
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 48

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.5	-4.7	-4.3	-4.4	-3.6	-4.2	-5.0	-5.2	-4.3	-4.7	-2.0
0.063	-3.7	-4.2	-4.0	-3.5	-2.9	-2.8	-3.8	-4.1	-2.4	-4.5	-0.1
0.080	-5.7	-6.0	-5.3	-5.9	-5.1	-4.5	-5.7	-6.1	-4.3	-6.1	-1.1
0.100	-4.0	-4.2	-3.7	-4.0	-2.9	-1.6	-3.5	-3.0	-1.3	-2.2	4.5
0.125	-0.9	-1.4	-1.3	-0.8	0.7	2.0	-0.0	2.0	4.3	4.9	5.8
0.160	-4.7	-5.5	-5.0	-3.8	-1.9	-1.2	-2.8	-0.2	3.1	4.9	1.5
0.200	-2.8	-3.4	-2.3	-0.1	2.1	1.3	2.6	7.3	7.4	15.9	-1.7
0.250	-0.1	-1.1	0.3	5.5	10.1	7.8	14.8	19.6	12.3	27.3	-3.1
0.315	1.5	-0.3	3.6	15.7	23.4	5.3	26.7	25.1	8.0	◆◆◆◆◆◆◆	-3.5
0.400	10.1	9.3	16.8	21.2	25.7	4.6	28.1	24.4	7.9	22.2	0.2
0.500	7.5	15.8	21.1	22.9	23.1	4.7	27.2	24.3	10.0	25.3	-0.9
0.630	5.0	12.5	20.4	34.3	28.0	5.8	29.0	30.3	12.6	29.4	-0.3
0.800	-0.7	3.7	14.2	31.3	21.0	-0.6	21.4	24.2	3.3	22.1	0.0
1.000	-3.9	-1.7	6.6	31.5	19.9	-4.9	22.5	17.4	6.2	19.7	0.3
1.250	-3.2	-4.9	3.8	28.2	15.9	-6.6	17.8	17.2	4.4	18.0	-0.0
1.600	2.3	-4.3	4.2	27.9	15.5	-5.3	18.4	17.5	-0.6	18.3	0.4
2.000	2.1	-3.4	7.1	30.1	16.4	-0.3	21.2	19.9	11.1	20.3	0.1
2.500	-4.7	-5.3	1.2	26.6	16.2	1.2	18.6	15.2	6.8	15.7	0.1
3.150	2.0	-1.2	2.6	26.4	14.8	-0.9	16.1	14.3	1.1	8.6	0.1
4.000	-3.3	1.5	0.7	27.5	18.4	-3.7	17.2	13.2	4.9	-3.5	-0.0

Table A-5.1

Results for Measurements Over Asphalt Concrete, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 18

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	34.5	30.1	74.9	70.0	69.3	67.0	63.2	66.9	64.0	63.7	96.6
0.063	33.0	34.1	79.5	74.9	74.1	70.1	73.0	71.5	67.7	69.6	101.2
0.080	93.7	39.9	34.6	30.0	79.0	72.2	76.4	74.6	69.2	72.6	106.0
0.100	94.3	90.6	34.9	79.3	73.3	63.1	74.1	63.2	65.0	71.2	103.2
0.125	93.1	90.9	35.3	76.7	75.5	73.1	67.0	66.0	66.7	65.2	109.6
0.160	91.2	92.7	37.0	76.2	74.9	30.1	66.4	71.4	72.4	69.6	112.2
0.200	33.4	92.2	37.6	77.7	75.4	35.3	79.3	73.2	32.1	73.4	113.0
0.250	39.6	36.4	32.6	32.3	76.5	32.3	72.9	72.9	73.1	67.6	110.7
0.315	91.5	73.4	77.3	77.3	71.1	74.2	71.2	61.7	72.4	60.9	106.2
0.400	97.4	74.3	71.0	72.3	60.1	77.5	62.7	59.3	73.1	60.6	106.3
0.500	97.9	33.2	63.6	72.1	53.5	72.6	52.9	55.3	69.3	49.5	109.9
0.630	96.7	97.9	31.6	76.4	71.1	30.3	63.2	66.3	73.6	61.5	116.0
0.800	103.4	96.3	39.3	73.5	77.3	32.6	72.7	73.1	72.5	69.3	115.7
1.000	95.4	33.6	90.5	92.9	31.6	33.5	77.3	77.3	79.6	71.5	114.2
1.250	99.3	95.0	35.1	79.7	75.0	32.7	73.5	70.6	75.9	69.3	112.6
1.600	97.9	37.2	31.3	79.2	70.3	77.5	69.7	65.3	70.9	55.3	111.9
2.000	95.3	92.9	32.7	75.0	70.7	77.0	67.9	64.1	66.9	56.3	111.3
2.500	95.4	90.9	35.0	74.3	72.1	79.2	63.5	61.5	67.5	52.3	110.3
3.150	93.2	39.7	30.3	69.0	64.4	72.9	61.1	53.4	57.1	*******	109.9
4.000	91.9	39.1	77.6	69.6	65.3	70.3	59.2	50.1	52.3	*******	109.0
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**10.0**

(b) Excess Attenuation, dB

RUN 18

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.3	-4.6	-5.4	-6.4	-5.8	-3.5	-8.3	-9.4	-6.5	-9.7	0.0
0.063	-2.2	-4.0	-5.4	-6.9	-6.0	-2.0	-8.4	-9.4	-5.6	-11.0	0.0
0.080	-3.1	-5.0	-5.7	-7.1	-6.1	0.7	-7.0	-7.9	-2.3	-9.3	-0.0
0.100	-1.5	-3.6	-3.8	-4.2	-3.2	7.0	-2.6	0.3	4.0	-5.8	-0.0
0.125	1.1	-2.5	-2.3	-0.2	1.0	3.4	5.9	4.4	3.7	1.6	-0.0
0.160	5.6	-1.7	-1.9	2.3	4.1	-1.1	9.0	1.5	0.5	-0.4	0.0
0.200	14.2	-0.4	-1.8	2.1	4.4	-5.5	-3.1	0.4	-8.5	-3.5	-0.0
0.250	5.7	3.1	0.9	-4.9	0.9	-4.9	0.9	-1.3	-7.0	-0.2	0.0
0.315	-0.3	11.6	1.2	-4.5	1.7	-1.4	-2.0	4.8	-5.9	1.7	0.0
0.400	-6.1	10.3	8.5	1.1	13.3	-4.1	6.9	7.1	-6.2	2.5	0.0
0.500	-3.6	0.4	13.9	4.2	17.8	3.7	19.6	14.5	0.5	16.2	0.0
0.630	3.3	-3.2	7.1	6.0	11.3	1.6	10.4	9.5	2.2	10.2	0.0
0.800	-3.2	-1.9	-1.0	3.4	4.2	-0.7	5.4	2.1	2.7	1.2	0.0
1.000	3.3	4.3	-3.8	-2.6	-1.3	-3.2	-1.5	-3.9	-5.2	-2.5	-0.0
1.250	-2.7	-3.3	-0.1	-1.3	3.4	-4.3	0.3	0.7	-4.5	-3.2	-0.0
1.600	-1.7	3.1	2.7	-2.0	6.9	-0.3	3.2	3.9	-1.2	3.3	-0.0
2.000	0.3	-3.2	0.5	1.1	5.4	-0.9	3.6	3.3	1.1	5.4	-0.0
2.500	-0.4	-2.0	-2.8	0.3	2.5	-4.6	6.0	3.9	-2.1	5.9	-0.0
3.150	0.8	-2.0	-0.2	3.2	7.3	-0.7	5.2	3.1	4.4	*******	-0.0
4.000	0.9	-2.9	0.9	0.3	3.1	-1.4	2.6	5.7	3.5	*******	0.0

Table A-5.2

Results for Measurements Over Asphalt Concrete, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 24

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	34.5	79.3	75.0	69.3	69.0	65.9	67.9	66.6	63.3	62.6	95.9
0.063	33.0	34.0	79.7	74.3	74.0	63.0	72.0	70.6	66.3	67.5	100.3
0.080	94.1	90.0	35.2	30.0	79.1	70.3	75.0	74.1	69.4	73.3	106.0
0.100	94.5	90.3	35.5	77.4	76.2	71.3	66.9	73.4	65.6	69.6	107.9
0.125	93.3	91.1	35.3	67.5	64.5	79.3	75.2	74.3	70.7	69.7	110.0
0.160	91.7	93.2	37.6	79.4	77.4	36.0	90.0	72.3	91.1	73.0	112.9
0.200	32.9	92.5	33.7	34.7	31.9	37.5	79.0	73.7	32.1	70.0	113.4
0.250	91.4	35.6	80.3	30.1	73.2	75.7	71.1	66.1	63.3	66.3	110.9
0.315	93.2	69.7	77.2	77.0	69.3	79.2	69.3	66.3	74.9	59.2	106.6
0.400	93.5	30.3	66.6	73.5	65.0	31.7	63.0	59.5	73.2	54.5	107.1
0.500	97.9	90.2	77.3	73.1	70.1	75.5	62.2	57.5	66.6	60.5	110.4
0.630	99.5	93.6	37.5	74.2	71.0	77.4	64.7	63.3	70.0	63.7	116.4
0.800	104.2	93.4	33.5	32.0	31.3	30.0	75.7	70.3	72.2	71.1	115.3
1.000	97.4	31.7	39.4	31.5	91.0	32.6	74.4	71.9	74.4	70.5	114.4
1.250	101.5	97.9	31.6	33.5	76.6	33.0	72.7	69.5	75.5	63.2	112.6
1.600	99.3	99.4	33.3	73.9	71.3	33.3	69.4	69.0	71.2	60.9	111.3
2.000	96.3	91.3	32.6	76.5	72.7	79.4	67.1	62.9	67.9	60.4	111.3
2.500	97.0	92.1	33.7	72.5	69.3	72.3	64.0	60.5	63.4	50.3	111.1
3.150	94.6	39.0	31.4	70.5	63.6	69.9	59.7	54.0	53.6	43.4	109.9
4.000	93.9	90.3	74.9	65.1	61.7	66.3	53.7	49.0	54.5	51.0	103.9
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	10.0

(b) Excess Attenuation, dB

RUN 24

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.0	-5.0	-6.2	-6.9	-6.2	-3.1	-9.6	-9.9	-6.5	-9.4	0.0
0.063	-2.6	-4.3	-6.0	-7.1	-6.3	-0.3	-7.3	-3.9	-4.6	-9.4	0.0
0.080	-3.5	-5.1	-6.3	-7.1	-6.2	2.1	-5.6	-7.3	-2.6	-10.0	-0.0
0.100	-2.0	-4.1	-4.7	-2.6	-1.4	3.0	4.4	-4.7	3.1	-4.5	0.0
0.125	0.3	-2.3	-2.9	9.4	12.4	-3.0	-1.9	-3.6	0.0	-2.6	0.0
0.160	5.3	-1.5	-1.9	0.3	2.3	-6.3	-3.9	0.3	-7.5	-3.1	0.0
0.200	15.1	-0.3	-2.5	-4.5	-1.7	-7.3	-2.5	0.3	-9.1	0.3	0.0
0.250	4.1	4.1	2.9	-2.5	4.4	1.9	2.9	5.2	2.5	0.3	-0.0
0.315	-2.1	15.7	2.2	-3.3	3.9	-6.0	0.2	0.1	-9.0	3.9	0.0
0.400	-6.9	5.6	13.2	-4.3	9.7	-9.0	6.9	7.7	-6.0	3.3	0.0
0.500	-3.0	-1.0	5.3	-1.2	6.3	1.4	10.9	12.9	3.3	5.9	-0.0
0.630	1.4	-3.5	1.6	9.6	11.3	5.4	14.3	12.4	6.2	3.4	0.0
0.800	-3.9	1.1	-0.1	0.0	0.7	2.0	2.5	4.5	3.1	-0.0	0.0
1.000	1.5	1.4	-1.5	-1.0	-0.5	-2.1	2.1	1.6	-0.9	-1.3	0.0
1.250	-4.4	-6.7	3.4	-5.1	1.3	-4.6	1.6	1.7	-5.3	-1.3	-0.0
1.600	-3.6	0.9	-4.3	3.3	5.4	-6.1	3.4	0.5	-1.7	3.5	-0.0
2.000	-0.7	-1.7	0.5	-0.5	3.3	-3.4	4.2	4.3	-0.2	1.5	-0.0
2.500	-1.7	-2.9	-1.3	2.3	5.0	2.5	5.6	4.9	2.0	7.7	-0.0
3.150	-0.7	-1.4	-1.0	1.5	3.4	2.1	6.2	7.0	2.4	3.1	-0.0
4.000	-1.2	-4.3	3.3	3.3	6.7	1.6	7.4	5.9	0.3	-7.2	-0.0

Table A-5.3

Results for Measurements Over Asphalt Concrete, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 30

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	33.3	79.7	74.3	70.0	69.1	67.0	67.9	66.2	64.4	62.9	96.6
0.063	37.3	34.2	79.3	75.0	74.2	70.4	73.2	71.3	63.9	63.5	101.1
0.080	93.0	33.4	34.6	30.4	79.3	72.9	77.4	75.7	71.3	72.3	105.3
0.100	93.9	90.4	95.5	30.3	79.6	69.5	77.5	73.7	67.3	70.3	103.0
0.125	93.3	90.6	36.1	30.5	79.0	67.1	75.7	70.0	67.6	72.3	109.4
0.160	93.2	92.9	33.1	32.3	30.5	77.0	73.7	71.9	73.4	74.3	112.5
0.200	37.4	92.0	37.0	75.4	72.2	32.3	73.9	73.7	76.7	70.6	113.1
0.250	34.5	37.5	32.7	75.3	71.2	33.2	67.7	71.1	73.3	70.3	110.7
0.315	33.6	76.3	73.1	73.7	67.2	90.0	65.4	65.0	75.3	66.3	106.4
0.400	95.3	70.7	64.0	73.0	59.0	72.5	56.9	61.2	71.7	59.9	107.0
0.500	93.4	36.5	71.4	70.3	61.3	74.0	54.3	52.9	69.7	49.2	110.1
0.630	94.5	96.3	33.3	76.3	73.5	77.2	66.9	63.7	72.3	56.0	116.1
0.800	101.5	97.1	39.2	31.0	79.0	33.7	73.1	63.4	76.6	72.3	115.6
1.000	93.0	90.4	90.7	79.6	79.2	33.3	76.7	76.0	75.2	69.1	114.3
1.250	93.3	92.9	33.6	91.1	74.5	91.0	76.0	71.6	75.2	67.1	112.4
1.600	95.1	90.3	91.1	73.3	74.7	77.9	65.0	61.5	72.4	59.7	111.7
2.000	95.3	91.3	33.0	74.3	73.4	77.0	69.7	65.7	69.1	57.7	111.3
2.500	95.3	33.7	32.0	73.3	69.7	74.7	62.7	59.1	65.3	56.7	110.3
3.150	93.3	33.0	79.3	70.6	66.2	71.4	60.4	56.3	56.6	43.3	110.2
4.000	92.9	37.5	79.7	69.0	62.9	69.6	54.4	50.2	53.2	44.4	109.2
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**10.0**

(b) Excess Attenuation, dB

RUN 30

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-2.6	-4.2	-5.3	-6.5	-5.6	-3.5	-3.0	-3.3	-7.0	-3.9	0.0
0.063	-2.1	-4.2	-5.3	-7.0	-6.2	-2.4	-3.7	-9.3	-6.9	-10.0	0.0
0.080	-2.6	-4.7	-5.9	-7.7	-6.6	-0.2	-3.2	-9.1	-4.7	-9.7	-0.0
0.100	-1.3	-3.6	-4.6	-5.9	-4.7	5.4	-6.2	-4.9	1.5	-5.1	0.0
0.125	0.7	-2.4	-3.3	-4.3	-2.3	9.2	-3.0	0.1	2.5	-5.3	-0.0
0.160	3.9	-1.6	-2.7	-3.5	-1.2	2.3	2.0	1.3	-0.2	-4.3	-0.0
0.200	10.3	-0.1	-1.1	4.5	7.7	-2.9	2.3	-0.0	-3.0	-0.7	0.0
0.250	10.3	2.0	0.3	2.1	6.2	-5.3	6.0	0.0	-7.7	-2.9	0.0
0.315	2.3	3.4	6.1	-0.7	5.3	-7.0	3.9	1.7	-9.1	-4.0	0.0
0.400	-3.3	15.1	15.7	0.5	14.5	1.0	12.9	5.9	-4.6	3.3	-0.0
0.500	-3.9	2.3	11.4	5.6	14.7	2.5	13.0	17.1	0.3	16.3	-0.0
0.630	6.1	-2.0	5.4	5.5	3.9	5.2	11.7	12.1	3.0	15.7	0.0
0.800	-1.4	-2.3	-1.0	0.3	2.3	-1.9	-0.2	6.7	-1.5	-1.5	0.0
1.000	-0.2	2.6	-3.9	0.7	1.1	-3.5	-0.3	-2.6	-1.3	-0.1	0.0
1.250	-2.9	-1.9	1.2	-2.9	3.7	-2.3	-1.9	-0.6	-4.2	-0.3	0.0
1.600	1.0	-0.1	2.3	-1.2	2.4	-0.3	7.3	3.0	-2.9	4.7	-0.0
2.000	0.3	-2.1	0.2	1.2	2.7	-0.9	1.7	2.1	-1.3	4.4	-0.0
2.500	-0.3	0.2	0.2	0.3	4.9	-0.1	6.3	6.3	-0.4	2.0	-0.0
3.150	1.0	-0.0	1.1	1.9	6.3	1.1	6.2	4.9	5.2	9.6	0.0
4.000	0.1	-1.1	-1.0	0.1	6.2	0.5	7.6	5.3	2.3	0.3	-0.0

Table A-5.4

Results for Measurements Over Asphalt Concrete, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 40

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.9	81.3	76.3	71.1	70.0	66.7	69.1	67.5	64.3	63.2	96.1
0.063	89.7	95.9	81.3	75.6	74.5	69.6	73.0	71.9	67.6	69.4	101.7
0.080	94.6	90.7	86.0	79.9	77.5	72.3	74.3	74.6	63.3	73.0	105.6
0.100	95.0	91.5	86.4	76.6	75.1	75.6	72.3	74.2	60.5	63.6	107.4
0.125	93.9	91.9	87.0	75.7	73.2	81.2	77.6	74.5	75.0	74.0	109.0
0.160	92.0	94.1	90.0	81.0	73.5	86.5	83.3	77.3	83.2	75.9	112.0
0.200	82.7	92.3	83.7	82.3	80.1	85.4	79.3	77.0	81.5	74.4	112.2
0.250	91.6	83.1	85.7	82.6	76.1	81.1	72.0	74.5	72.7	63.3	110.3
0.315	92.4	74.3	79.1	75.3	65.0	81.3	63.3	65.6	77.4	65.7	105.4
0.400	93.6	75.4	73.5	77.0	60.5	77.6	60.6	59.9	70.7	60.6	106.4
0.500	97.9	83.3	73.1	74.5	63.6	74.2	59.0	62.4	66.7	51.3	109.2
0.630	99.2	93.4	84.2	74.2	70.7	74.7	73.1	74.1	72.3	65.3	115.4
0.800	104.3	97.0	91.0	76.6	76.2	82.0	72.4	79.9	73.2	73.6	114.9
1.000	97.3	93.5	92.4	79.2	75.2	83.1	75.2	79.7	74.5	75.1	113.4
1.250	100.6	95.3	84.9	80.9	72.4	83.3	66.6	69.2	74.3	63.9	111.5
1.600	93.7	96.6	81.1	77.5	74.4	75.6	65.6	72.0	66.3	61.7	110.6
2.000	96.4	93.4	84.4	76.1	71.2	73.1	60.3	66.7	64.5	61.9	110.3
2.500	97.3	92.6	84.5	74.1	69.5	71.2	63.3	66.1	61.2	54.1	110.4
3.150	94.4	90.9	81.3	74.0	67.5	68.4	57.0	53.0	59.5	49.9	109.2
4.000	93.3	96.5	80.5	67.2	64.4	61.2	49.6	55.3	54.0	50.6	107.9
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	10.0

(b) Excess Attenuation, dB

RUN 40

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.2	-6.3	-7.3	-8.1	-7.0	-3.7	-9.6	-10.5	-7.3	-9.7	0.0
0.063	-3.4	-5.3	-6.7	-7.0	-5.9	-1.0	-7.9	-9.2	-5.0	-10.4	-0.0
0.080	-4.4	-6.2	-7.5	-6.3	-5.0	-0.3	-5.3	-9.1	-1.3	-10.1	-0.0
0.100	-3.0	-5.2	-6.1	-2.3	-0.3	-1.3	-2.1	-6.0	7.7	-3.9	0.0
0.125	-0.3	-4.1	-5.1	0.2	2.7	-5.3	-5.3	-4.7	-5.2	-7.3	0.0
0.160	4.6	-3.3	-5.1	-2.2	0.3	-7.7	-9.0	-4.6	-10.5	-6.9	-0.0
0.200	14.1	-1.9	-3.6	-3.3	-1.1	-6.4	-4.4	-4.2	-9.7	-5.3	0.0
0.250	3.3	1.0	-2.6	-5.6	0.9	-4.1	1.4	-3.7	-1.9	-2.7	-0.0
0.315	-2.4	9.4	-0.9	-3.7	7.1	-9.2	0.1	0.2	-11.6	-3.7	0.0
0.400	-7.7	9.9	5.7	-4.0	12.5	-4.6	9.7	6.7	-4.1	2.2	0.0
0.500	-4.2	-0.3	9.3	1.2	12.1	1.5	13.0	6.9	2.6	14.0	-0.0
0.630	0.7	-4.3	3.9	7.6	11.1	7.1	5.0	1.2	2.5	6.0	0.0
0.800	-4.9	-3.4	-3.5	4.6	5.0	-0.3	5.0	-5.3	1.4	-3.2	0.0
1.000	0.6	2.6	-6.4	1.4	4.4	-3.5	0.5	-5.9	-1.7	-6.6	0.0
1.250	-4.6	-5.7	-1.0	-3.5	5.0	-5.9	6.3	1.2	-3.9	-3.0	0.0
1.600	-3.7	2.5	1.9	-1.3	1.3	0.6	6.4	-3.2	2.5	2.2	-0.0
2.000	-1.2	-4.2	-1.6	-0.2	4.7	2.9	11.1	1.2	3.4	0.6	-0.0
2.500	-3.1	-4.0	-2.5	0.5	6.1	3.4	6.4	-0.3	4.6	5.3	0.0
3.150	-1.1	-3.9	-1.7	-1.9	4.6	3.7	9.5	3.9	3.3	4.3	-0.0
4.000	-1.5	-1.2	-2.7	1.5	4.3	7.5	12.4	0.5	2.3	-4.0	0.0

Table A-5.5

Results for Measurements Over Asphalt Concrete, Source Height = 10 m

(a) One-Third Octave Band Levels, dB

RUN 46

FREQU. KHZ	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	84.7	79.9	75.0	69.3	63.3	67.2	67.2	65.1	63.3	61.1	95.9
0.063	83.5	84.3	80.0	75.1	74.2	71.3	72.7	71.3	70.0	63.5	101.3
0.080	94.3	90.3	85.7	80.9	79.7	75.3	77.3	75.7	73.0	73.3	106.1
0.100	94.9	91.2	86.5	91.9	80.6	73.5	77.9	74.9	71.4	73.5	107.9
0.125	94.3	92.0	87.7	82.3	81.1	70.6	73.0	73.4	71.0	71.5	109.7
0.160	93.1	94.3	90.5	84.3	83.4	74.6	73.9	73.3	74.1	72.2	112.6
0.200	84.3	93.6	90.3	84.5	83.7	80.2	74.5	63.1	75.7	75.2	112.3
0.250	83.7	89.9	83.1	84.6	81.5	81.5	72.5	69.3	76.7	75.6	110.6
0.315	91.1	80.3	83.5	81.6	79.1	77.9	72.3	71.4	74.3	71.9	106.1
0.400	97.3	70.3	80.3	80.7	77.3	71.5	72.3	63.5	72.0	69.0	106.4
0.500	93.9	85.7	69.9	77.9	72.0	73.3	64.6	59.3	63.9	64.3	109.5
0.630	95.7	97.1	73.4	82.6	75.1	77.9	57.5	66.1	72.1	65.9	116.0
0.800	103.7	93.7	80.6	85.3	73.1	81.2	69.2	61.9	76.2	69.3	115.4
1.000	96.3	94.2	83.6	85.5	79.4	80.4	74.5	65.3	75.9	63.7	114.0
1.250	101.1	90.3	89.7	83.7	79.3	73.3	75.5	63.3	74.0	65.9	111.9
1.600	97.6	92.5	87.5	80.3	77.4	76.7	65.2	59.9	71.1	60.7	110.9
2.000	96.0	90.3	77.3	80.3	76.4	73.2	67.5	61.2	65.4	60.5	111.1
2.500	96.2	89.7	85.3	77.0	75.5	72.5	63.6	56.7	64.5	59.6	110.5
3.150	94.7	83.2	81.5	77.9	70.5	63.7	55.7	51.6	61.1	53.3	109.4
4.000	93.9	89.4	80.0	76.7	71.0	63.5	55.6	49.7	54.9	55.9	103.4
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	10.0

(b) Excess Attenuation, dB

RUN 46

FREQU. KHZ	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.2	-5.1	-6.1	-7.0	-5.9	-4.4	-9.0	-3.3	-7.1	-7.3	0.0
0.063	-2.6	-4.1	-5.3	-6.9	-6.0	-3.1	-3.0	-9.1	-7.3	-9.9	0.0
0.080	-3.6	-5.3	-6.7	-7.9	-6.7	-2.3	-7.3	-3.7	-6.0	-10.4	0.0
0.100	-2.4	-4.5	-5.7	-7.1	-5.3	1.3	-6.7	-6.1	-2.7	-3.4	0.0
0.125	-0.0	-3.5	-5.1	-5.7	-4.5	6.0	-5.0	-2.9	-0.5	-4.6	0.0
0.160	4.1	-2.9	-5.0	-4.9	-4.0	4.3	-3.1	-0.0	-0.3	-2.6	-0.0
0.200	12.6	-2.0	-4.6	-4.9	-4.1	-0.6	1.5	5.3	-2.3	-5.5	-0.0
0.250	6.5	-0.5	-4.7	-7.3	-4.2	-4.2	1.2	1.2	-5.7	-3.3	-0.0
0.315	-0.5	4.1	-4.6	-3.9	-6.4	-5.2	-3.3	-5.0	-3.4	-9.4	0.0
0.400	-6.9	14.4	-1.7	-7.3	-4.9	1.4	-3.6	-2.0	-5.5	-5.4	0.0
0.500	-4.9	2.5	12.3	-2.0	3.9	2.6	7.6	9.6	0.5	1.1	0.0
0.630	4.3	-2.4	15.2	-0.3	7.2	4.5	21.1	9.6	3.6	5.7	0.0
0.800	-3.3	-4.6	7.4	-4.2	3.5	0.4	3.5	13.0	-1.3	1.3	0.0
1.000	2.2	-1.5	-2.1	-5.4	0.7	-0.3	1.6	7.3	-2.3	0.0	-0.0
1.250	-4.7	-0.3	-5.4	-6.0	-1.6	-0.6	-1.9	7.3	-3.4	0.0	-0.0
1.600	-2.3	-3.1	-4.4	-3.9	-1.0	-0.3	6.9	9.0	-2.2	3.1	0.0
2.000	-0.5	-0.3	5.3	-4.2	-0.3	2.9	4.0	6.3	2.6	2.0	-0.0
2.500	-1.4	-1.0	-3.2	-2.4	-0.9	2.1	6.1	9.1	1.2	-0.3	0.0
3.150	-1.2	-0.9	-1.2	-5.7	1.7	3.5	10.9	10.4	0.9	1.0	-0.0
4.000	-1.6	-3.6	-1.7	-7.5	-1.3	5.7	6.9	7.2	2.0	-3.9	-0.0

Table A-6.1

Results for Measurements Over Asphalt Concrete, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 17

FREQU. KHZ	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.1	81.1	76.5	72.0	71.4	69.2	70.6	69.7	67.0	67.4	93.3
0.063	90.6	86.0	82.1	78.0	77.4	73.9	76.6	76.0	71.6	74.8	102.7
0.080	96.1	91.5	87.4	83.9	82.9	77.5	81.7	80.9	73.6	80.0	107.1
0.100	97.4	92.6	88.5	84.4	83.5	75.3	81.9	78.3	68.8	78.6	105.7
0.125	97.5	92.7	88.3	84.5	83.3	73.1	82.3	80.0	65.1	76.9	112.0
0.160	100.3	95.9	91.0	86.4	85.3	76.0	83.9	81.7	67.7	76.7	111.0
0.200	99.9	95.5	89.3	85.0	84.1	79.9	82.3	78.0	75.2	74.3	110.2
0.250	94.3	91.4	81.5	82.3	79.2	80.7	71.6	73.4	77.9	72.3	111.6
0.315	83.6	84.0	71.3	77.3	71.9	81.6	72.5	69.3	76.2	67.2	106.5
0.400	78.5	81.3	71.1	76.4	67.9	77.3	62.4	62.1	73.9	59.3	109.1
0.500	94.2	77.2	70.0	75.5	65.5	77.9	63.9	61.0	72.6	58.3	110.3
0.630	104.0	87.9	75.0	75.7	73.4	75.3	69.3	63.5	71.3	68.9	116.4
0.800	102.2	93.3	81.5	84.3	82.6	74.6	75.1	70.1	75.3	71.5	115.3
1.000	95.0	96.3	88.5	84.7	82.8	81.5	80.7	72.9	74.1	72.7	114.3
1.250	101.3	90.3	84.2	82.4	79.4	83.2	75.9	69.9	75.7	65.7	112.7
1.600	93.3	87.1	75.7	75.6	68.5	77.9	68.0	65.1	70.4	66.5	111.9
2.000	99.0	88.3	82.6	76.0	74.0	75.4	71.1	67.3	67.3	58.0	111.3
2.500	96.2	86.9	79.0	73.1	69.3	74.0	65.7	59.4	63.9	58.3	110.9
3.150	95.5	85.4	79.6	74.4	71.0	70.6	61.1	59.4	61.5	●●●●●●●	110.1
4.000	94.4	86.3	75.5	66.3	62.8	68.5	55.2	53.5	52.9	●●●●●●●	109.0
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 17

FREQU. KHZ	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.6	-5.5	-7.0	-9.5	-7.9	-5.7	-10.6	-12.2	-9.5	-13.5	-1.7
0.063	-4.5	-5.9	-8.0	-9.9	-9.3	-5.8	-12.0	-13.9	-9.5	-16.3	-2.5
0.080	-5.2	-6.6	-8.5	-10.9	-10.0	-4.6	-12.3	-14.1	-6.3	-16.7	-1.1
0.100	-4.3	-5.5	-7.4	-9.3	-8.6	-0.3	-10.4	-9.3	0.2	-13.2	2.5
0.125	-3.0	-4.2	-5.8	-8.0	-6.8	3.4	-9.4	-9.7	5.3	-10.2	-2.4
0.160	-3.2	-4.9	-5.9	-7.4	-6.3	3.0	-8.5	-9.3	5.2	-7.5	0.3
0.200	-2.0	-3.6	-3.4	-5.2	-4.3	-0.1	-6.6	-4.4	-1.6	-4.4	-1.2
0.250	1.3	-1.9	2.0	-5.4	-1.3	-3.3	2.2	-2.3	-6.7	-5.4	-0.9
0.315	7.5	1.1	7.7	-4.5	0.9	-8.5	-3.4	-2.3	-9.7	-4.5	-0.3
0.400	13.2	4.4	8.5	-3.0	5.5	-4.4	7.2	4.3	-6.6	4.2	-1.3
0.500	0.5	11.4	12.5	0.8	10.3	-1.2	9.6	8.9	-2.9	7.5	-1.0
0.630	-3.1	6.9	13.7	6.7	9.0	7.1	9.3	12.3	4.0	3.3	-0.4
0.800	-1.7	0.7	6.8	-2.9	-0.7	7.3	3.0	5.1	-0.1	-0.5	-0.1
1.000	4.0	-3.3	-1.8	-4.4	-2.5	-1.2	-4.4	0.9	-0.7	-3.7	-0.1
1.250	-3.9	1.0	0.9	-4.0	-1.0	-4.3	-1.2	1.4	-4.4	0.9	-0.1
1.600	2.8	3.3	8.3	1.6	8.7	-0.7	4.9	4.6	-0.7	-1.9	0.3
2.000	-3.0	1.0	0.6	0.1	2.1	0.7	0.4	0.1	0.1	3.2	-0.0
2.500	-0.9	2.1	4.2	1.6	5.4	0.7	3.9	6.1	1.6	2.2	-0.1
3.150	-1.2	2.4	1.0	-2.1	1.3	1.7	5.3	2.1	0.0	●●●●●●●	-0.2
4.000	-1.2	-0.5	3.1	2.7	6.2	0.5	6.1	2.4	2.9	●●●●●●●	0.0

Table A-6.2

Results for Measurements Over Asphalt Concrete, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 23

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.5	80.4	76.0	71.5	70.3	63.6	70.1	68.5	65.7	64.5	97.7
0.063	89.9	85.1	80.3	77.1	76.4	72.2	76.2	75.0	70.4	72.1	102.5
0.080	96.0	91.2	87.6	85.2	84.3	77.2	82.3	82.0	75.1	79.4	106.6
0.100	97.1	92.0	88.4	85.1	84.0	75.0	82.2	79.6	70.2	78.0	105.1
0.125	97.4	92.7	88.9	85.0	83.7	73.1	81.9	79.1	65.2	74.1	111.5
0.160	101.2	97.2	92.3	86.2	85.1	78.7	84.9	81.9	70.3	75.9	111.4
0.200	100.3	96.2	88.5	86.4	85.3	81.6	79.6	79.3	77.6	72.0	113.6
0.250	95.5	93.6	82.2	88.3	82.6	84.3	80.1	71.9	81.0	70.0	111.4
0.315	86.5	88.3	73.1	73.7	68.5	77.7	75.7	72.4	78.0	64.8	106.1
0.400	80.6	81.3	66.6	83.4	68.3	73.1	66.7	64.6	75.3	62.5	107.8
0.500	95.8	79.7	70.0	76.6	65.4	76.5	63.2	58.1	69.9	57.2	110.8
0.630	104.3	90.9	78.0	73.2	74.0	77.0	74.3	67.3	71.5	69.7	116.2
0.800	103.8	97.0	89.5	86.3	85.1	81.9	83.1	75.3	79.6	73.5	115.5
1.000	95.7	99.0	90.8	87.7	85.3	84.3	84.0	77.1	73.5	69.4	114.0
1.250	102.2	91.5	92.9	85.6	83.0	85.3	84.0	74.3	78.1	67.4	112.2
1.600	93.7	88.6	78.5	80.5	76.1	78.8	74.1	72.3	73.1	59.2	111.3
2.000	99.3	90.3	80.2	79.3	73.0	76.6	70.1	65.0	63.4	55.6	111.2
2.500	98.5	90.8	79.3	77.6	73.7	75.9	69.3	64.7	64.5	54.8	111.1
3.150	96.7	86.9	77.9	71.5	67.3	74.6	62.9	56.0	60.4	53.5	109.5
4.000	94.4	85.9	75.2	70.3	63.6	71.7	60.4	54.0	54.0	54.4	108.4
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 23

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.7	-5.5	-7.2	-8.7	-8.0	-5.3	-10.8	-11.7	-8.9	-11.2	-1.8
0.063	-4.2	-5.4	-7.1	-9.4	-8.7	-4.5	-12.0	-13.3	-8.7	-14.0	-1.7
0.080	-5.1	-6.3	-8.7	-12.3	-11.4	-4.3	-13.4	-15.2	-8.3	-16.1	-0.6
0.100	-4.3	-5.2	-7.6	-10.3	-9.2	-0.2	-11.0	-10.9	-1.5	-12.9	2.8
0.125	-2.5	-3.3	-6.0	-8.1	-6.3	3.3	-8.6	-8.4	5.6	-7.0	-1.5
0.160	-3.4	-5.4	-7.0	-6.5	-5.4	1.0	-8.8	-8.3	3.3	-6.0	1.5
0.200	-2.0	-3.9	-2.2	-6.2	-5.1	-1.4	-3.1	-5.3	-3.6	-1.7	-0.2
0.250	0.3	-3.9	1.5	-10.7	-5.0	-6.7	-6.1	-0.6	-9.7	-2.4	-0.5
0.315	5.0	-2.3	6.3	-5.5	4.7	-4.5	-6.2	-5.5	-11.1	-1.7	0.5
0.400	11.4	4.2	14.3	-9.7	5.4	0.6	3.2	2.6	-8.1	0.8	-0.7
0.500	-0.5	9.5	13.1	0.3	11.5	0.4	9.9	12.3	0.5	9.2	-0.4
0.630	-3.5	4.3	11.1	4.6	8.3	5.3	4.7	8.9	4.7	2.4	0.2
0.800	-3.2	-2.4	-1.1	-4.3	-3.1	0.1	-4.9	0.0	-4.3	-2.4	0.3
1.000	3.5	-5.3	-3.9	-7.2	-4.8	-4.3	-7.5	-3.5	-4.9	-0.2	0.4
1.250	-4.3	-0.2	-7.9	-7.2	-4.6	-6.9	-9.7	-3.6	-6.9	-0.9	0.4
1.600	2.9	1.8	5.5	-3.3	1.1	-1.6	-1.2	-2.7	-3.5	5.3	0.5
2.000	-3.3	-0.5	3.0	-3.2	-1.9	-0.5	1.4	2.9	4.5	6.6	0.1
2.500	-2.3	-1.5	3.2	-2.7	1.2	-1.0	-0.0	1.0	1.2	4.2	-0.0
3.150	-2.4	0.9	2.7	0.7	4.4	-2.4	3.4	5.4	1.0	-0.3	0.4
4.000	-1.3	0.3	3.2	-1.5	5.2	-2.9	1.3	1.5	1.6	-9.6	0.5

Table A-6.2

Results for Measurements Over Asphalt Concrete, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 23

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.5	80.4	76.0	71.5	70.8	68.6	70.1	68.5	65.7	64.5	97.7
0.063	89.9	85.1	80.8	77.1	76.4	72.2	76.2	75.0	70.4	72.1	102.5
0.080	96.0	91.2	87.6	85.2	84.3	77.2	82.3	82.0	75.1	79.4	106.6
0.100	97.1	92.0	88.4	85.1	84.0	75.0	82.2	79.6	70.2	78.0	105.1
0.125	97.4	92.7	88.9	85.0	83.7	73.1	81.9	79.1	65.2	74.1	111.5
0.160	101.2	97.2	92.8	86.2	85.1	78.7	84.9	81.9	70.3	75.9	111.4
0.200	100.3	96.2	88.5	86.4	85.3	81.6	79.6	79.3	77.6	72.0	113.6
0.250	95.5	93.6	82.2	83.3	82.6	84.3	80.1	71.9	81.0	70.0	111.4
0.315	96.5	88.3	73.1	78.7	68.5	77.7	75.7	72.4	78.0	64.8	106.1
0.400	80.6	81.8	65.5	83.4	68.3	73.1	65.7	64.6	75.3	62.5	107.8
0.500	95.8	79.7	70.0	76.6	65.4	76.5	63.2	58.1	69.9	57.2	110.8
0.630	104.8	90.9	78.0	73.2	74.0	77.0	74.3	67.3	71.5	69.7	116.2
0.800	103.8	97.0	89.5	86.3	85.1	81.9	83.1	75.3	79.6	73.5	115.5
1.000	95.7	99.0	90.8	87.7	85.3	84.3	84.0	77.1	78.5	69.4	114.0
1.250	102.2	91.5	92.9	85.6	83.0	85.3	84.0	74.8	78.1	67.4	112.2
1.600	93.7	88.6	78.5	80.5	76.1	78.8	74.1	72.3	73.1	59.2	111.3
2.000	99.3	90.3	80.2	79.3	78.0	76.6	70.1	65.0	63.4	55.6	111.2
2.500	98.5	90.8	79.3	77.6	73.7	75.9	69.3	64.7	64.5	54.8	111.1
3.150	96.7	86.9	77.9	71.5	67.3	74.6	62.9	56.0	60.4	53.5	109.5
4.000	94.4	85.9	75.2	70.3	63.6	71.7	60.4	54.0	54.0	54.4	108.4
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 23

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.7	-5.5	-7.2	-8.7	-8.0	-5.8	-10.8	-11.7	-8.9	-11.2	-1.8
0.063	-4.2	-5.4	-7.1	-9.4	-8.7	-4.5	-12.0	-13.3	-8.7	-14.0	-1.7
0.080	-5.1	-6.3	-8.7	-12.3	-11.4	-4.3	-13.4	-15.2	-8.3	-16.1	-0.6
0.100	-4.3	-5.2	-7.6	-10.3	-9.2	-0.2	-11.0	-10.9	-1.5	-12.9	2.8
0.125	-2.5	-3.3	-6.0	-8.1	-6.8	3.8	-8.6	-8.4	5.6	-7.0	-1.5
0.160	-2.4	-5.4	-7.0	-6.5	-5.4	1.0	-8.8	-8.3	3.3	-6.0	1.5
0.200	-2.0	-3.9	-2.2	-6.2	-5.1	-1.4	-3.1	-5.3	-3.6	-1.7	-0.2
0.250	0.3	-3.8	1.5	-10.7	-5.0	-6.7	-6.1	-0.6	-9.7	-2.4	-0.5
0.315	5.0	-2.3	6.3	-5.5	4.7	-4.5	-6.2	-5.5	-11.1	-1.7	0.5
0.400	11.4	4.2	14.3	-9.7	5.4	0.6	3.2	2.6	-8.1	0.8	-0.7
0.500	-0.5	9.5	13.1	0.3	11.5	0.4	9.9	12.3	0.5	9.2	-0.4
0.630	-3.5	4.3	11.1	4.6	8.3	5.8	4.7	8.9	4.7	2.4	0.2
0.800	-3.2	-2.4	-1.1	-4.3	-3.1	0.1	-4.9	0.0	-4.3	-2.4	0.3
1.000	3.5	-5.8	-3.9	-7.2	-4.8	-4.3	-7.5	-3.5	-4.9	-0.2	0.4
1.250	-4.8	-0.2	-7.9	-7.2	-4.6	-6.9	-9.7	-3.6	-6.9	-0.9	0.4
1.600	2.9	1.8	5.5	-3.3	1.1	-1.6	-1.2	-2.7	-3.5	5.3	0.5
2.000	-3.3	-0.5	3.0	-3.2	-1.9	-0.5	1.4	2.9	4.5	6.6	0.1
2.500	-2.8	-1.5	3.2	-2.7	1.2	-1.0	-0.0	1.0	1.2	4.2	-0.0
3.150	-2.4	0.9	2.7	0.7	4.4	-2.4	3.4	5.4	1.0	-0.3	0.4
4.000	-1.3	0.3	3.2	-1.5	5.2	-2.9	1.3	1.5	1.6	-9.6	0.5

Table A-6.3

Results for Measurements Over Asphalt Concrete, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 29

FREQU. KHz	1 MIC 1‡	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	79.9	80.2	75.4	71.1	70.1	68.3	68.9	68.0	66.3	64.8	98.1
0.063	84.3	85.0	80.7	76.7	75.7	72.5	74.6	74.1	71.2	71.8	103.1
0.080	90.1	90.7	86.1	82.7	81.5	76.8	79.8	79.4	75.2	78.0	106.8
0.100	91.5	91.8	87.3	84.1	82.8	76.6	81.0	79.6	73.0	78.6	105.4
0.125	91.2	91.7	87.3	84.3	82.8	72.5	80.8	78.0	69.8	74.5	111.4
0.160	94.2	95.1	90.7	88.0	86.0	69.9	83.1	80.3	72.1	75.4	110.8
0.200	93.9	94.8	89.6	87.1	84.8	67.5	80.4	79.1	68.1	73.1	113.5
0.250	90.0	92.2	86.5	80.3	78.9	76.8	76.8	70.4	74.4	69.8	111.6
0.315	81.2	85.6	77.0	73.8	70.0	76.5	61.6	65.4	71.8	61.1	105.8
0.400	77.1	82.7	71.7	72.2	64.4	79.1	65.4	59.4	74.7	59.2	107.9
0.500	85.8	76.3	67.6	71.6	63.4	73.1	57.2	58.2	68.3	54.7	110.5
0.630	96.7	87.7	74.4	78.9	74.0	72.8	62.0	57.9	70.3	56.9	116.3
0.800	98.0	93.6	84.1	82.1	77.2	82.6	70.4	67.6	73.6	64.4	115.5
1.000	93.4	97.1	87.1	81.2	80.6	80.5	79.6	74.4	77.3	66.9	114.4
1.250	91.3	92.3	88.1	81.7	78.8	82.2	72.9	70.5	72.9	69.2	112.3
1.600	92.1	82.5	82.8	73.7	70.0	76.5	69.6	64.2	70.9	60.0	111.5
2.000	90.3	90.7	80.7	75.4	75.2	78.0	63.8	60.7	64.7	57.0	111.4
2.500	90.1	84.7	82.6	73.6	68.9	74.8	64.8	62.8	65.2	55.8	110.3
3.150	89.0	87.2	79.6	70.0	63.3	68.9	59.5	*	53.9	44.1	109.9
4.000	89.9	85.7	74.4	67.1	61.7	69.3	56.8	*	53.3	43.9	108.9
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 29

FREQU. KHz	1 MIC 1‡	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	1.6	-4.6	-5.9	-7.6	-6.6	-4.8	-8.9	-10.5	-8.8	-10.8	-1.5
0.063	1.7	-5.0	-6.7	-8.7	-7.7	-4.5	-10.1	-12.1	-9.2	-13.4	-2.0
0.080	0.6	-6.0	-7.4	-10.0	-8.8	-4.1	-10.6	-12.8	-8.6	-14.9	-1.0
0.100	1.4	-4.9	-6.4	-9.2	-7.9	-1.7	-9.7	-10.8	-4.2	-13.4	2.6
0.125	3.1	-3.4	-5.0	-8.1	-6.6	3.7	-8.1	-7.9	0.3	-8.0	-2.0
0.160	3.2	-3.7	-5.3	-8.7	-6.7	9.4	-7.4	-7.2	1.0	-5.9	1.7
0.200	4.1	-2.8	-3.6	-7.3	-5.0	12.4	-4.2	-5.5	5.5	-3.2	-0.4
0.250	5.6	-2.6	-3.0	-2.9	-1.5	0.6	-3.1	0.7	-3.3	-2.5	-0.9
0.315	10.1	-0.3	2.2	-0.8	3.0	-3.5	7.7	1.3	-5.1	1.7	0.6
0.400	14.8	3.2	8.0	1.3	9.1	-5.6	4.4	7.7	-7.6	4.0	-0.9
0.500	9.2	12.6	15.2	4.9	13.1	3.4	15.6	11.8	1.7	11.3	-0.4
0.630	4.2	7.2	14.4	3.5	8.4	9.6	16.6	17.9	5.5	14.7	-0.2
0.800	2.4	0.8	4.1	-0.3	4.6	-0.8	7.5	7.4	1.4	6.4	0.1
1.000	5.7	-4.1	-0.3	-0.9	-0.3	-0.2	-3.3	-1.0	-3.9	2.0	-0.1
1.250	5.9	-1.2	-3.3	-3.5	-0.6	-4.0	1.1	0.4	-2.0	-3.0	0.1
1.600	4.3	7.8	1.1	3.3	7.0	0.5	3.1	5.2	-1.5	4.2	0.2
2.000	5.7	-1.0	2.5	0.6	0.8	-2.0	7.5	7.0	3.0	4.8	-0.1
2.500	5.3	4.3	-0.4	0.9	5.6	-0.3	4.5	2.4	-0.0	2.5	-0.0
3.150	5.6	0.8	1.2	2.3	9.0	3.4	6.8		2.5	3.3	0.3
4.000	3.4	0.8	4.2	1.8	7.2	-0.4	4.8		2.1	0.5	0.3

* Recorded signal quality not acceptable.

‡ 6 dB subtracted from these values for averaged data due to apparent calibration error.

Table A-6.4

Results for Measurements Over Asphalt Concrete, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 39

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	87.0	81.9	77.5	74.0	72.9	70.1	72.9	72.1	68.0	68.3	98.6
0.063	91.7	87.0	82.8	79.6	78.7	74.1	78.3	77.4	72.0	74.9	103.4
0.080	96.7	91.9	87.5	84.8	83.7	77.1	82.1	80.9	74.4	79.9	106.0
0.100	98.1	93.1	88.7	85.6	84.3	75.7	82.6	79.9	71.7	80.1	105.4
0.125	97.8	93.1	88.8	83.9	82.5	75.0	82.2	78.6	70.4	77.2	110.3
0.160	101.3	97.1	92.9	85.5	84.4	81.9	87.3	79.0	80.3	73.4	110.8
0.200	99.9	96.4	91.9	78.3	79.1	85.1	87.0	80.4	81.3	70.6	113.1
0.250	95.8	94.1	89.4	81.0	76.5	82.5	81.7	76.0	81.6	73.0	110.7
0.315	86.4	88.0	83.2	83.4	78.0	70.2	73.1	75.6	70.6	70.5	105.0
0.400	79.7	84.2	79.9	84.0	75.7	74.1	70.1	70.3	73.0	61.6	107.8
0.500	95.1	76.8	71.2	77.9	65.6	69.4	62.7	66.0	72.1	60.3	109.9
0.630	104.5	87.1	76.6	73.1	69.1	78.9	74.5	69.1	74.1	69.9	115.5
0.800	104.2	95.1	87.6	80.7	81.0	78.0	76.6	73.7	73.5	71.8	115.0
1.000	95.9	98.7	92.7	80.2	81.4	82.0	83.4	72.7	76.6	76.3	113.6
1.250	101.4	95.1	93.5	84.6	79.9	80.9	82.8	70.1	77.6	71.2	111.6
1.600	94.4	82.4	88.1	74.4	74.8	73.8	75.7	69.4	68.0	65.9	110.7
2.000	99.8	91.9	80.6	76.8	73.0	75.3	71.3	64.7	68.4	59.5	110.8
2.500	98.3	88.2	88.0	75.6	68.9	75.6	76.0	60.9	63.9	59.3	110.4
3.150	97.6	90.8	79.4	72.1	68.5	72.2	65.9	59.8	62.0	47.9	109.2
4.000	93.6	83.8	80.7	69.8	65.4	66.8	63.6	52.4	56.3	49.9	107.8
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**5.0**

(b) Excess Attenuation, dB

RUN 39

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-6.0	-6.8	-8.4	-10.9	-9.9	-7.0	-13.4	-15.1	-11.0	-14.8	-2.5
0.063	-5.1	-6.4	-8.2	-11.0	-10.1	-5.5	-13.2	-14.8	-9.4	-15.9	-1.7
0.080	-6.2	-7.4	-9.0	-12.3	-11.2	-4.6	-13.1	-14.4	-7.9	-17.0	-0.4
0.100	-5.8	-6.8	-8.4	-11.3	-10.0	-1.4	-11.9	-11.7	-3.5	-15.5	2.0
0.125	-3.9	-5.2	-6.9	-8.0	-6.6	0.9	-9.9	-8.8	-0.6	-11.0	-1.3
0.160	-4.4	-6.2	-8.0	-6.7	-5.6	-3.1	-12.0	-6.3	-7.6	-4.3	1.2
0.200	-2.8	-5.3	-6.8	0.7	-0.1	-6.1	-11.6	-7.6	-8.5	-1.4	-0.9
0.250	-0.6	-4.9	-6.3	-4.0	0.5	-5.5	-8.3	-5.2	-10.8	-5.9	-0.4
0.315	3.9	-3.7	-5.0	-11.3	-5.9	1.9	-4.7	-9.8	-4.8	-8.5	0.4
0.400	11.6	1.1	-0.7	-11.0	-2.7	-1.1	-0.8	-3.7	-6.4	1.2	-1.4
0.500	-1.0	11.3	10.8	-2.2	10.1	6.3	9.3	3.3	-2.8	5.1	-0.7
0.630	-4.2	7.1	11.5	8.8	12.7	2.9	3.6	6.2	1.2	1.4	-0.1
0.800	-4.5	-1.4	-0.0	0.5	0.2	3.2	0.3	0.9	1.1	-1.3	-0.1
1.000	2.3	-6.5	-6.7	-0.6	-1.8	-2.4	-7.7	0.1	-3.8	-7.8	-0.2
1.250	-5.1	-4.9	-9.5	-7.1	-2.4	-3.4	-9.4	0.3	-7.2	-5.3	-0.1
1.600	1.0	6.8	-5.2	1.8	1.4	2.4	-3.7	-0.6	0.8	-1.9	-0.1
2.000	-4.3	-2.6	2.2	-0.9	2.9	0.6	0.1	3.2	-0.5	3.0	-0.0
2.500	-3.3	0.5	-6.0	-1.0	5.7	-1.0	-6.3	4.9	1.9	0.2	0.0
3.150	-3.9	-3.6	0.8	-0.0	3.6	-0.1	0.6	2.1	-0.1	6.4	-0.0
4.000	-1.4	1.6	-2.9	-1.1	3.3	1.9	-1.6	4.0	0.1	-3.4	0.1

Table A-6.5

Results for Measurements Over Asphalt Concrete, Source Height = 5 m

(a) One-Third Octave Band Levels, dB

RUN 45

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.0	80.7	76.1	72.2	71.1	69.5	70.7	69.9	66.8	66.1	98.5
0.063	91.1	85.9	81.6	78.1	76.9	74.4	77.0	76.2	71.6	73.7	103.5
0.080	96.7	91.4	86.7	83.6	82.3	78.8	82.0	81.1	74.9	79.0	105.9
0.100	97.9	92.6	87.9	84.9	83.4	78.5	83.0	80.6	72.9	79.4	106.0
0.125	97.6	92.6	88.2	84.5	83.2	76.3	82.6	79.6	70.8	77.4	111.5
0.160	101.1	96.7	92.6	87.8	86.8	77.2	85.3	84.4	70.9	78.1	111.3
0.200	100.2	96.3	92.1	86.1	85.3	77.8	81.9	84.9	70.7	80.0	113.6
0.250	97.0	94.9	91.2	83.3	81.5	79.9	79.3	82.6	69.4	78.2	111.8
0.315	88.6	89.3	87.5	83.6	81.0	77.8	75.3	77.9	76.6	73.3	105.9
0.400	84.7	83.0	87.1	84.8	81.1	71.7	73.1	77.7	69.7	63.2	108.2
0.500	93.3	77.8	82.3	79.4	74.0	72.3	68.3	70.3	70.8	66.2	110.3
0.630	103.6	77.3	84.7	71.1	70.3	75.4	73.0	64.6	68.5	62.9	116.3
0.800	105.1	87.0	85.1	80.5	70.9	76.1	74.2	75.1	73.1	67.0	115.7
1.000	100.1	95.1	83.0	83.3	77.4	81.2	77.2	73.6	74.3	67.0	114.3
1.250	98.4	96.3	84.5	87.8	79.0	78.0	77.1	77.6	73.9	62.7	112.2
1.600	99.0	92.5	82.4	84.6	78.1	76.2	75.9	67.9	69.7	59.9	111.2
2.000	96.3	84.9	84.3	86.1	82.5	73.6	70.2	67.0	68.7	55.3	111.4
2.500	96.8	91.7	83.8	83.7	82.1	77.5	72.7	65.6	66.5	58.5	110.9
3.150	96.0	90.2	81.8	71.1	81.7	74.0	70.3	59.8	57.3	55.6	109.8
4.000	96.5	85.6	78.8	79.7	76.4	62.8	70.1	58.6	55.8	57.4	108.6
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	5.0

(b) Excess Attenuation, dB

RUN 45

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.2	-5.8	-7.2	-9.4	-8.3	-6.6	-11.4	-13.1	-10.0	-12.8	-2.6
0.063	-4.9	-5.7	-7.4	-9.9	-8.7	-6.2	-12.3	-14.0	-9.4	-15.0	-2.2
0.080	-5.7	-6.4	-7.7	-10.6	-9.3	-5.8	-12.5	-14.1	-7.9	-15.6	-0.8
0.100	-5.1	-5.8	-7.1	-10.1	-8.6	-3.7	-11.8	-11.9	-4.2	-14.3	1.9
0.125	-3.0	-4.0	-5.6	-7.9	-6.6	0.3	-9.6	-9.1	-0.3	-10.5	-1.8
0.160	-3.6	-5.2	-7.1	-8.4	-7.4	2.2	-9.5	-11.1	2.4	-8.5	1.3
0.200	-2.5	-4.6	-6.4	-6.5	-5.7	1.8	-5.9	-11.5	2.7	-10.3	-0.3
0.250	-1.5	-5.4	-7.8	-6.5	-4.2	-2.6	-5.6	-11.6	1.7	-10.9	-1.2
0.315	2.4	-4.8	-8.6	-10.9	-8.3	-5.1	-6.3	-11.5	-10.2	-10.7	0.2
0.400	6.6	-2.7	-7.9	-11.9	-8.2	1.2	-3.9	-11.2	-3.2	-0.6	-1.8
0.500	1.1	10.5	-0.1	-3.5	1.9	3.6	3.9	-0.9	-1.4	-0.8	-0.8
0.630	-2.8	17.5	4.0	11.3	12.0	6.9	5.5	11.1	7.2	3.7	-0.3
0.800	-4.9	7.2	2.9	1.1	10.7	5.5	3.5	-0.2	1.8	3.6	-0.3
1.000	-1.3	-2.4	3.5	-3.2	2.7	-1.1	-1.1	-0.5	-1.7	1.7	-0.3
1.250	-1.7	-5.7	-0.2	-10.1	-1.3	-0.3	-3.5	-7.0	-3.3	3.2	-0.3
1.600	-3.3	-3.0	0.7	-8.2	-1.7	0.2	-4.8	1.0	-0.8	4.0	-0.3
2.000	-1.0	4.7	-1.2	-10.0	-6.4	-2.5	1.3	1.0	-0.7	6.7	-0.3
2.500	-1.7	-2.9	-1.7	-9.1	-7.5	-2.9	-3.0	0.2	-0.7	0.9	-0.4
3.150	-2.1	-2.8	-1.5	1.1	-9.5	-1.8	-3.7	2.3	4.7	-1.2	-0.4
4.000	-3.8	0.3	-0.4	-10.5	-7.2	6.4	-7.5	-1.6	1.1	-10.3	-0.2

Table A-7.1

Results for Measurements Over Asphalt Concrete, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 12

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	87.1	82.4	77.8	73.1	72.3	71.1	71.3	71.1	68.4	68.1	100.4
0.063	92.6	88.1	84.0	79.6	79.3	76.4	78.3	78.4	74.0	76.4	104.6
0.080	97.7	93.1	88.9	85.8	85.4	81.0	84.1	83.7	78.0	81.9	109.1
0.100	93.1	93.5	89.6	87.3	86.7	79.2	85.2	82.3	74.0	82.0	106.8
0.125	97.1	92.6	88.7	86.1	85.3	74.2	84.3	80.5	69.6	77.6	101.9
0.160	104.6	100.4	96.8	94.4	93.7	79.3	91.1	89.0	74.5	84.8	109.4
0.200	103.6	99.0	95.1	92.2	91.7	71.3	88.1	83.6	72.4	79.6	112.9
0.250	100.1	95.7	91.5	89.7	87.0	62.3	82.8	81.0	60.6	74.5	114.0
0.315	96.6	93.3	88.6	85.0	83.0	63.7	78.5	74.6	66.6	69.7	112.4
0.400	94.4	91.5	85.7	84.6	80.4	76.2	74.4	67.8	66.7	65.8	109.8
0.500	86.8	82.6	76.8	80.6	69.3	73.7	66.3	61.4	70.7	55.3	114.8
0.630	91.5	79.3	74.2	83.2	72.5	74.0	64.1	61.7	72.5	62.0	116.7
0.800	100.6	89.1	81.6	84.1	80.3	76.5	74.4	75.2	72.8	70.9	115.7
1.000	104.8	96.2	83.4	85.3	85.1	84.5	81.6	76.2	79.6	76.3	116.2
1.250	102.0	96.3	84.8	85.7	85.6	76.4	78.0	75.7	74.8	71.6	113.9
1.600	94.7	93.7	86.4	79.9	79.9	76.3	72.0	71.7	69.9	63.3	112.1
2.000	98.3	82.7	77.3	76.5	71.6	76.7	70.3	66.2	68.4	62.8	112.0
2.500	97.4	91.3	82.0	76.3	74.3	70.9	70.8	62.8	63.2	53.7	111.4
3.150	98.4	85.9	75.9	73.5	72.0	70.9	66.4	60.0	61.1	53.3	110.7
4.000	92.0	86.0	76.5	72.8	69.2	67.6	61.6	58.3	54.9	57.0	109.3
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**2.5**

(b) Excess Attenuation, dB

RUN 12

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-4.4	-5.7	-7.1	-8.5	-9.2	-6.5	-10.7	-12.5	-9.8	-13.0	-2.7
0.063	-4.8	-6.3	-8.2	-9.9	-9.6	-6.7	-12.1	-14.7	-10.3	-16.3	-1.8
0.080	-6.1	-7.5	-9.4	-12.3	-11.9	-7.5	-14.1	-16.3	-10.6	-18.0	-2.5
0.100	-4.1	-5.5	-7.7	-11.4	-10.8	-3.3	-12.9	-13.0	-4.2	-15.8	2.2
0.125	-1.3	-2.8	-5.0	-8.4	-7.6	3.5	-10.2	-8.9	2.0	-9.6	8.9
0.160	-6.2	-8.1	-10.5	-14.2	-13.5	1.0	-14.5	-14.9	-0.4	-14.3	4.0
0.200	-4.6	-6.1	-8.2	-11.4	-10.9	9.4	-10.9	-9.0	2.2	-8.7	1.1
0.250	-3.1	-4.8	-6.6	-11.0	-8.3	16.4	-7.7	-8.5	11.9	-5.7	-2.0
0.315	-4.6	-7.4	-8.8	-11.3	-9.3	5.0	-3.5	-7.2	0.8	-6.1	-5.4
0.400	-2.0	-5.2	-5.5	-10.6	-6.4	-2.2	-4.0	-0.2	1.0	-2.0	-2.4
0.500	9.1	7.2	6.9	-3.2	3.1	3.8	7.0	9.7	0.3	11.8	-3.9
0.630	10.2	16.3	15.2	-0.0	10.7	9.2	15.3	15.0	4.1	10.6	0.0
0.800	0.7	6.1	7.5	-1.4	2.4	6.2	4.5	0.9	3.3	1.1	0.7
1.000	-5.2	-2.7	3.9	-4.4	-4.2	-3.6	-4.6	-2.1	-5.5	-6.5	-1.5
1.250	-3.9	-4.4	0.9	-6.6	-6.5	2.7	-2.9	-3.6	-2.7	-4.1	-0.7
1.600	2.9	-2.4	-1.4	-1.7	-1.7	1.9	2.0	-0.9	0.9	2.0	0.6
2.000	-1.6	7.7	6.1	0.3	5.2	0.1	2.0	2.5	0.3	0.4	-0.1
2.500	-0.9	-1.2	1.3	-0.6	1.5	4.9	-0.1	3.9	3.5	6.4	0.4
3.150	-3.1	2.8	5.7	-0.3	1.3	2.4	1.0	2.6	1.5	1.2	0.1
4.000	2.1	1.2	2.9	-2.9	0.7	2.2	1.2	-1.5	1.9	-10.7	0.5

Table A-7.2

Results for Measurements Over Asphalt Concrete, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 16

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	86.9	82.4	77.8	73.9	73.3	81.0	72.1	71.1	68.8	67.7	99.9
0.063	92.9	88.6	84.6	80.7	79.9	86.0	79.2	78.3	74.5	75.7	104.5
0.080	97.7	93.3	89.1	86.0	85.1	89.7	84.1	83.4	76.9	80.7	103.6
0.100	98.2	93.9	90.4	87.8	86.6	88.5	85.2	82.8	73.0	80.1	106.4
0.125	96.9	92.3	89.3	86.5	85.1	80.6	83.4	79.9	68.9	77.1	101.2
0.160	104.8	101.1	97.6	94.3	93.3	82.7	90.5	83.3	75.0	82.5	109.4
0.200	103.6	99.7	96.5	92.9	91.8	74.5	83.6	85.5	60.6	77.6	112.6
0.250	100.5	96.3	92.3	90.4	87.1	76.6	83.2	80.1	65.5	73.3	113.5
0.315	96.7	93.6	88.8	85.2	83.2	82.5	79.4	76.2	69.2	64.9	112.0
0.400	94.7	91.7	86.6	84.3	80.9	82.9	75.7	69.5	69.2	60.5	103.8
0.500	87.9	81.6	78.3	84.6	70.6	81.0	65.8	58.7	71.8	57.0	114.4
0.630	94.4	89.1	74.0	84.3	77.3	85.7	71.7	66.5	71.0	65.3	116.3
0.800	101.9	93.1	86.2	83.3	81.3	90.6	76.2	74.7	75.0	72.3	115.6
1.000	106.3	97.1	95.8	90.9	83.3	85.9	82.3	75.7	72.1	71.3	115.7
1.250	102.2	93.3	94.6	83.0	80.3	91.9	77.2	75.2	74.9	68.4	113.8
1.600	94.0	86.0	85.6	83.5	76.7	83.9	73.3	65.5	68.0	57.5	111.5
2.000	99.3	87.9	82.5	78.0	74.7	85.2	69.8	63.2	64.6	53.4	112.0
2.500	99.6	91.9	87.7	78.5	76.2	79.8	65.6	58.5	59.3	•••••••	111.8
3.150	98.3	87.2	79.7	74.6	70.4	80.5	62.2	59.5	59.5	•••••••	110.5
4.000	94.5	86.7	79.5	69.5	64.0	71.9	53.9	49.0	51.0	•••••••	109.1
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**2.5**

(b) Excess Attenuation, dB

RUN 16

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.3	-6.8	-8.2	-10.4	-9.8	-17.5	-12.1	-13.6	-11.3	-13.8	-3.3
0.063	-6.7	-8.4	-10.5	-12.6	-11.8	-17.9	-14.6	-16.2	-12.4	-17.2	-3.3
0.080	-6.7	-8.3	-10.2	-13.1	-12.2	-16.8	-14.7	-16.6	-10.1	-17.4	-2.6
0.100	-5.0	-6.7	-9.3	-12.7	-11.5	-13.4	-13.7	-13.8	-4.0	-14.7	1.8
0.125	-2.3	-4.3	-6.8	-10.0	-8.6	-4.1	-10.5	-9.6	1.4	-10.4	8.4
0.160	-7.6	-10.0	-12.5	-15.3	-14.3	-3.7	-15.1	-15.4	-2.1	-13.3	2.8
0.200	-5.6	-7.8	-10.6	-13.1	-12.0	5.3	-12.4	-11.9	12.9	-7.7	0.4
0.250	-4.8	-6.7	-8.8	-13.0	-9.7	0.8	-9.4	-9.0	5.6	-5.9	-2.8
0.315	-5.5	-8.5	-9.8	-12.4	-10.4	-9.7	-10.3	-9.7	-2.7	-2.2	-5.8
0.400	-2.9	-6.0	-7.0	-10.9	-7.5	-9.5	-6.1	-2.6	-2.3	2.6	-2.0
0.500	6.9	7.1	4.2	-8.3	5.7	-4.7	6.7	11.1	-2.0	8.7	-4.6
0.630	6.5	5.7	14.7	-1.9	5.1	-3.3	6.9	9.3	4.8	6.3	-0.8
0.800	-1.3	1.4	2.1	-1.9	0.6	-8.7	1.9	0.5	0.2	-1.3	0.1
1.000	-7.2	-4.1	-9.1	-10.6	-8.0	-5.6	-6.0	-2.3	1.3	-2.3	-1.5
1.250	-4.7	-2.0	-9.6	-4.6	-2.4	-13.5	-2.9	-3.9	-3.6	-1.9	-1.2
1.600	2.6	4.4	-1.6	-6.3	0.5	-6.7	-0.9	4.2	1.7	7.1	0.3
2.000	-3.2	1.9	0.7	-1.9	1.4	-9.1	1.7	4.7	3.3	3.8	-0.7
2.500	-4.1	-2.8	-5.4	-3.8	-1.5	-5.1	4.0	7.0	6.2	•••••••	-1.0
3.150	-3.9	0.6	0.9	-2.3	1.9	-8.2	4.2	2.0	2.1	•••••••	-0.6
4.000	-1.2	-0.3	-0.9	-0.5	5.0	-2.9	8.0	6.9	4.9	•••••••	-0.1

Table A-7.3

Results for Measurements Over Asphalt Concrete, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 22

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	85.9	81.0	76.9	72.6	71.9	70.1	71.6	70.2	67.2	65.9	98.8
0.063	91.7	86.9	82.8	78.6	77.9	74.5	78.1	77.2	72.9	74.0	103.2
0.080	97.0	92.2	88.1	85.4	84.6	78.6	83.3	82.8	76.6	80.3	107.6
0.100	97.7	92.8	88.9	86.3	85.6	76.9	84.5	81.1	72.2	79.9	104.9
0.125	96.6	92.0	88.3	86.2	84.8	71.0	82.8	78.4	70.2	74.7	102.1
0.160	104.1	100.1	97.2	94.8	93.5	72.9	90.3	87.9	76.1	79.7	110.2
0.200	102.9	98.7	94.8	91.5	90.6	66.6	88.5	85.1	60.0	80.9	113.3
0.250	100.0	95.8	91.8	89.0	85.8	65.3	81.5	79.4	63.0	73.2	113.7
0.315	96.0	92.6	87.1	84.3	82.0	71.8	79.1	74.0	64.1	68.1	111.2
0.400	93.3	91.0	84.3	78.0	77.9	77.6	72.3	67.9	73.1	64.5	107.6
0.500	90.3	80.5	74.2	82.9	71.4	72.9	66.8	61.8	70.5	54.1	113.1
0.630	93.5	88.6	79.9	83.2	76.4	75.7	69.8	67.6	72.6	60.3	117.1
0.800	104.2	94.9	85.7	88.4	87.7	84.0	78.0	78.3	78.1	69.2	115.5
1.000	106.2	98.1	88.8	90.2	88.5	75.9	83.3	79.2	76.2	70.6	114.4
1.250	103.3	98.6	90.1	86.9	86.2	79.3	84.7	74.0	70.3	70.3	112.4
1.600	96.9	96.9	88.5	82.3	83.0	78.9	71.0	67.6	68.3	58.6	111.8
2.000	99.6	91.3	80.9	77.3	75.2	75.0	72.4	63.6	66.5	58.7	111.2
2.500	99.7	86.0	88.8	74.4	72.3	71.8	68.1	61.9	59.6	49.4	111.1
3.150	99.0	89.7	80.3	73.9	73.4	70.6	62.3	57.8	55.5	50.2	109.8
4.000	93.3	84.7	76.4	68.4	68.6	65.7	57.4	50.6	49.4	53.1	108.8
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 22

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-5.0	-6.1	-8.0	-9.8	-9.1	-7.3	-12.3	-13.4	-10.4	-12.7	-2.9
0.063	-5.9	-7.1	-9.1	-10.9	-10.2	-6.8	-13.9	-15.5	-11.2	-15.9	-2.4
0.080	-6.0	-7.2	-9.2	-12.5	-11.7	-5.7	-13.9	-16.0	-9.3	-17.0	-1.6
0.100	-4.3	-5.9	-8.1	-12.0	-10.8	-2.1	-13.3	-12.4	-3.5	-14.8	3.0
0.125	-1.6	-3.1	-5.4	-9.3	-7.9	5.9	-9.5	-7.7	0.5	-7.6	7.9
0.160	-6.2	-8.3	-11.4	-15.1	-13.8	6.8	-14.2	-14.3	-2.5	-9.8	2.7
0.200	-4.5	-6.4	-8.5	-11.3	-10.4	13.6	-12.0	-11.1	13.9	-10.6	0.1
0.250	-4.1	-6.0	-8.1	-11.4	-8.2	12.3	-7.5	-8.1	3.3	-5.6	-2.8
0.315	-4.4	-7.1	-7.7	-11.1	-8.3	1.4	-9.6	-7.1	2.8	-5.0	-4.6
0.400	-1.7	-5.0	-4.4	-4.3	-4.2	-3.9	-2.4	-0.7	-5.9	-1.2	-0.5
0.500	5.1	8.8	8.9	-6.0	5.5	4.0	6.3	8.6	-0.1	12.2	-2.7
0.630	2.8	6.6	9.2	-0.4	6.4	7.1	9.2	8.6	3.6	11.8	-0.7
0.800	-3.5	-0.3	2.7	-6.4	-5.7	-2.0	0.2	-3.5	-2.8	1.9	0.3
1.000	-6.9	-4.9	3.1	-9.7	-8.0	4.6	-6.8	-5.6	-2.6	-1.4	-0.0
1.250	-5.8	-7.3	-5.1	-8.5	-7.8	-0.9	-10.4	-2.8	0.4	-3.7	0.2
1.600	-0.3	-6.5	-4.5	-5.1	-5.8	-1.7	1.9	2.0	1.3	6.0	-0.0
2.000	-3.5	-1.5	2.3	-1.2	0.9	1.1	-0.9	4.3	1.4	3.5	0.1
2.500	-3.9	3.3	-1.3	0.5	2.6	3.1	1.7	3.8	6.1	9.6	-0.0
3.150	-4.6	-1.9	0.3	-1.7	-1.2	1.6	4.0	3.6	5.9	2.9	0.1
4.000	-0.6	1.5	2.0	0.4	5.2	3.1	4.3	4.9	6.1	-3.3	0.1

Table A-7.4

Results for Measurements Over Asphalt Concrete, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 28

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	84.9	80.3	75.7	71.0	70.0	69.0	68.5	67.4	66.1	62.9	98.7
0.063	90.4	85.9	81.7	76.9	76.0	74.2	74.9	74.1	72.0	70.7	102.9
0.080	96.2	91.9	87.6	83.6	82.5	79.6	80.8	80.3	77.1	77.7	107.8
0.100	96.8	92.5	88.4	84.9	83.7	79.4	82.1	80.7	75.9	79.3	105.2
0.125	95.2	91.1	87.4	84.3	82.8	75.8	81.4	79.5	71.1	75.8	101.5
0.160	102.7	98.8	95.2	92.9	91.0	81.2	89.3	87.8	74.4	80.6	109.9
0.200	101.9	97.9	94.1	92.4	90.0	74.9	87.3	85.2	69.6	78.6	113.3
0.250	99.1	95.2	91.6	87.4	85.6	64.6	82.3	80.0	60.0	73.6	113.9
0.315	95.0	92.1	87.6	83.4	80.7	68.0	78.0	73.8	62.7	68.3	111.6
0.400	93.1	90.3	84.9	83.6	77.5	69.7	72.2	67.0	67.1	59.2	107.6
0.500	84.1	79.4	74.6	75.5	67.6	73.6	61.7	58.5	70.8	53.1	113.6
0.630	90.6	85.3	74.5	76.9	69.6	75.5	62.2	62.4	67.6	51.1	117.1
0.800	97.1	89.3	83.3	84.7	80.4	76.4	69.2	67.8	75.8	64.7	115.6
1.000	101.8	95.2	90.5	80.4	78.7	77.3	75.3	76.6	72.7	66.0	114.4
1.250	101.5	95.8	89.4	81.5	82.6	82.0	76.1	74.0	76.1	63.7	112.5
1.600	95.2	89.4	81.6	78.3	77.9	72.5	68.5	61.9	67.4	63.0	111.7
2.000	91.7	83.6	79.2	75.3	68.9	74.9	63.8	62.7	66.2	54.9	111.2
2.500	93.2	90.4	77.0	73.1	72.5	71.3	62.1	60.8	62.4	55.5	111.0
3.150	90.7	83.5	76.1	72.5	68.7	68.2	62.7	52.8	55.7	45.9	110.2
4.000	*										
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 28

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-3.3	-4.7	-6.1	-7.5	-6.5	-5.5	-8.5	-9.9	-8.6	-3.8	-2.1
0.063	-4.3	-5.8	-7.7	-8.9	-8.0	-6.2	-10.4	-12.1	-10.0	-12.3	-1.8
0.080	-5.4	-7.1	-8.9	-10.9	-9.8	-6.9	-11.6	-13.7	-10.5	-14.6	-2.0
0.100	-3.8	-5.5	-7.5	-10.0	-8.8	-4.5	-10.8	-11.9	-7.1	-14.1	2.9
0.125	-0.8	-2.8	-5.1	-8.1	-6.6	0.4	-9.7	-9.4	-1.0	-9.3	7.9
0.160	-5.2	-7.4	-9.8	-13.6	-11.7	-1.9	-13.6	-14.6	-1.2	-11.1	2.6
0.200	-3.8	-5.9	-9.1	-12.5	-10.1	5.0	-11.1	-11.6	4.1	-8.7	-0.2
0.250	-3.4	-5.6	-8.1	-10.0	-8.2	12.9	-9.6	-8.9	11.1	-6.3	-3.2
0.315	-3.6	-6.8	-9.4	-10.4	-7.7	5.0	-9.7	-7.1	4.0	-5.5	-5.2
0.400	-1.1	-4.4	-5.1	-10.1	-4.0	3.8	-2.4	0.1	0.0	4.0	-0.6
0.500	11.0	9.6	8.2	1.0	8.9	2.9	11.1	11.5	-0.8	12.9	-3.5
0.630	10.4	9.1	14.3	5.5	12.8	6.9	16.4	13.4	8.2	20.6	-1.0
0.800	3.4	4.6	4.9	-2.9	1.4	5.4	8.7	7.3	-0.7	6.1	0.0
1.000	-2.6	-2.1	-3.7	-0.1	1.6	3.0	1.1	-3.2	0.7	3.0	-0.1
1.250	-4.2	-4.7	-4.6	-3.3	-4.4	-3.8	-2.0	-3.0	-5.1	-2.4	-0.1
1.600	1.3	0.9	2.3	-1.2	-0.8	4.6	4.3	7.6	2.1	1.4	-0.0
2.000	4.4	6.2	4.0	0.8	7.2	1.2	7.6	5.1	1.6	7.2	0.1
2.500	-2.7	-1.4	5.2	1.5	2.1	3.3	7.3	4.5	2.9	3.1	-0.2
3.150	4.0	4.6	4.8	-0.1	3.7	4.2	3.8	8.9	5.9	7.4	0.0
4.000	*										

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*Data at 4000 Hz for this run were not valid.

Table A-7.5

Results for Measurements Over Asphalt Concrete, Source Height = 2.5 m

(a) One-Third Octave Band Levels, dB

RUN 33

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC* 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	97.5	92.1	77.4		72.6	71.5	*******	72.3	69.1	69.1	99.0
0.063	93.0	97.6	93.0		73.3	76.6	53.9	73.5	73.6	73.3	103.3
0.080	97.9	92.4	87.9		93.6	91.1	64.0	93.3	75.7	76.0	106.9
0.100	93.0	92.5	87.9		84.2	90.4	64.9	92.4	72.1	72.2	103.3
0.125	97.1	91.9	87.5		94.1	78.2	64.6	79.9	73.9	74.1	103.1
0.160	104.3	99.0	94.6		91.7	84.1	71.5	95.7	93.3	93.4	110.4
0.200	103.2	97.9	93.2		91.1	79.6	69.1	95.2	78.9	79.1	113.6
0.250	100.3	95.5	91.0		86.6	69.4	63.3	90.8	67.3	67.5	113.5
0.315	95.8	91.9	87.7		92.8	69.3	60.2	76.0	71.5	71.7	110.0
0.400	94.0	90.9	86.6		79.4	76.4	55.2	69.9	74.4	74.6	107.9
0.500	84.7	81.5	78.7		63.1	78.4	46.3	60.6	75.0	75.2	111.6
0.630	89.6	81.3	73.3		72.7	77.4	53.0	74.0	76.7	76.8	116.7
0.800	93.8	80.5	81.9		79.4	79.2	65.0	75.3	77.7	78.0	115.9
1.000	103.8	92.1	86.3		86.4	83.3	64.1	78.0	80.5	80.7	113.5
1.250	102.9	95.5	93.1		85.0	80.5	62.1	73.6	79.9	79.2	112.0
1.600	96.5	93.7	93.2		92.6	80.8	53.9	72.9	73.3	73.5	111.4
2.000	94.4	92.1	73.9		73.9	77.3	53.4	65.7	69.2	69.4	111.1
2.500	100.5	86.3	78.8		72.4	75.5	51.1	65.2	65.9	66.0	110.8
3.150	96.1	89.2	76.9		73.8	72.4	48.0	61.7	61.7	61.9	109.5
4.000	95.9	82.4	73.7		73.1	69.3	46.6	55.9	55.3	54.6	103.1
Dist (m)	28.1	56.2	112.5	225.0	225.0	225.0	337.5	450.0	450.0	675.0	5.0
Height (m)	1.2	1.2	1.2	0	1.2	10.0	1.2	1.2	10.0	1.2	2.5

(b) Excess Attenuation, dB

RUN 33

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC# 6	7 MIC# 7	8 MIC 8	9 MIC 9	10 MIC# 10	11 MIC 21
0.050	-6.4	-7.0	-8.3		-9.6	-8.4	*******	-15.3	-12.1	-15.7	-2.9
0.063	-6.3	-6.9	-8.4		-9.7	-8.0	6.3	-15.9	-11.0	-14.7	-1.6
0.080	-7.3	-7.8	-9.3		-11.1	-9.6	5.0	-16.9	-9.2	-13.1	-1.3
0.100	-5.6	-6.1	-7.6		-9.9	-6.1	5.9	-14.2	-3.9	-7.5	4.1
0.125	-3.1	-3.9	-5.6		-8.2	-2.3	7.7	-10.1	-4.1	-7.9	5.9
0.160	-7.3	-8.1	-9.7		-12.9	-5.3	3.8	-13.0	-10.6	-14.3	1.6
0.200	-6.0	-6.8	-8.1		-12.1	-0.6	7.3	-12.4	-6.1	-10.0	-1.4
0.250	-5.0	-6.3	-7.8		-9.6	7.6	10.1	-10.0	3.5	-0.4	-3.2
0.315	-5.4	-7.6	-9.5		-10.7	2.8	8.2	-10.2	-5.7	-9.7	-4.6
0.400	-2.6	-5.6	-7.4		-6.4	-3.4	14.2	-3.3	-7.8	-11.8	-1.5
0.500	9.5	6.6	3.3		7.6	-2.7	25.7	8.7	-5.7	-9.8	-2.4
0.630	10.9	13.0	14.9		9.1	4.4	25.1	1.3	-1.4	-5.5	-1.3
0.800	1.0	13.2	5.7		1.8	2.0	12.4	-0.7	-3.1	-7.5	-0.9
1.000	-5.5	0.1	-0.3		-6.8	-9.7	11.6	-5.2	-7.7	-12.2	-0.1
1.250	-6.5	-5.3	-4.1		-7.5	-3.0	11.4	-3.2	-8.5	-13.3	-0.5
1.600	-1.0	-4.4	-0.3		-6.4	-4.6	19.1	-4.0	-4.5	-9.5	-0.8
2.000	1.2	-2.8	9.0		2.0	-1.9	18.0	2.3	-0.2	-5.8	-0.3
2.500	-5.4	2.4	3.2		2.2	-0.9	19.7	0.7	0.1	-6.4	-0.4
3.150	-2.3	-2.0	3.3		-1.7	-0.3	18.5	0.3	0.3	-7.5	-0.3
4.000	-3.6	3.1	4.2		-4.3	-0.5	15.5	0.6	1.2	-7.3	-0.2

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* Recorded signal quality not acceptable.

# Calibration questionable, data not used for averages.

Table A-7.6

Results for Measurements Over Asphalt Concrete, Source Height = 2.5 m

(a) One-Thied Octave Band Levels, dB

RUN 44

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	97.0	81.9	77.6	73.3	72.9	70.9	73.1	72.7	68.6	69.2	93.6
0.063	92.1	97.2	83.2	79.9	73.9	75.2	79.1	73.9	72.7	75.9	102.7
0.080	97.5	92.5	83.6	86.2	85.1	79.6	84.6	83.4	76.0	81.6	107.0
0.100	93.3	93.3	89.7	87.6	86.3	73.0	85.6	81.6	75.9	82.9	104.7
0.125	97.3	92.5	89.2	86.9	85.6	71.0	83.3	79.9	73.6	77.3	101.6
0.160	104.5	99.3	96.5	94.2	93.1	67.5	89.7	89.5	75.4	83.7	109.0
0.200	103.2	93.1	94.6	92.5	91.6	69.3	87.1	87.4	69.2	81.0	112.7
0.250	100.6	96.0	92.2	89.0	86.6	64.5	84.1	81.4	67.2	73.2	113.2
0.315	95.7	91.9	88.7	92.3	91.6	63.1	80.1	75.5	68.6	72.2	110.2
0.400	94.6	91.2	88.3	81.1	79.6	73.0	79.7	74.4	69.5	70.6	107.3
0.500	84.3	94.2	83.6	73.6	69.7	70.1	74.3	64.3	71.1	61.3	112.6
0.630	86.6	83.9	79.2	85.3	72.6	72.3	67.4	74.1	72.5	67.2	116.2
0.800	97.3	76.3	81.3	91.2	83.3	80.3	90.5	77.0	79.5	71.9	114.7
1.000	102.3	82.9	81.2	93.3	87.7	73.6	81.9	74.2	76.0	73.5	113.3
1.250	102.7	90.5	81.1	85.1	77.9	73.1	81.4	72.1	74.0	67.6	111.6
1.600	97.5	91.0	84.9	95.5	81.2	69.9	73.5	65.9	67.2	63.3	110.6
2.000	91.5	90.1	83.3	85.5	81.2	66.9	67.9	66.1	63.5	61.3	110.7
2.500	99.9	87.6	79.4	81.3	80.3	64.7	66.4	62.0	60.3	55.3	110.2
3.150	92.3	93.7	74.5	91.0	73.4	61.2	64.2	58.5	54.6	51.5	109.2
4.000	96.3	97.4	75.2	75.3	71.1	60.3	59.5	55.6	54.5	55.3	103.0
Dist (m)	**28.1**	**56.2**	**112.5**	**225.0**	**225.0**	**225.0**	**337.5**	**450.0**	**450.0**	**675.0**	**5.0**
Height (m)	**1.2**	**1.2**	**1.2**	**0**	**1.2**	**10.0**	**1.2**	**1.2**	**10.0**	**1.2**	**2.5**

(b) Excess Attenuation, dB

RUN 44

FREQU. KHz	1 MIC 1	2 MIC 2	3 MIC 3	4 MIC 4	5 MIC 5	6 MIC 6	7 MIC 7	8 MIC 8	9 MIC 9	10 MIC 10	11 MIC 21
0.050	-6.1	-7.0	-3.7	-10.9	-10.1	-7.9	-13.3	-15.9	-11.3	-16.0	-2.7
0.063	-5.3	-6.9	-9.0	-11.7	-10.7	-7.0	-14.4	-16.6	-10.5	-17.3	-1.4
0.080	-6.4	-7.4	-9.6	-13.2	-12.1	-6.6	-15.1	-16.4	-9.0	-13.2	-0.9
0.100	-5.4	-6.4	-3.9	-12.3	-11.5	-3.2	-14.4	-12.9	-7.2	-17.3	3.2
0.125	-2.6	-3.3	-6.6	-10.3	-9.0	5.6	-10.3	-9.4	-3.1	-10.4	3.1
0.160	-6.9	-3.3	-11.0	-14.3	-13.7	11.9	-13.3	-16.2	-2.1	-14.0	3.6
0.200	-5.4	-6.4	-3.9	-12.9	-12.0	10.3	-11.1	-14.0	4.2	-11.3	0.1
0.250	-5.0	-6.5	-3.7	-11.7	-9.3	12.3	-10.4	-10.3	3.9	-10.3	-2.6
0.315	-4.6	-6.9	-9.3	-10.0	-3.3	9.7	-11.0	-9.0	-2.1	-9.5	-4.1
0.400	-3.2	-5.9	-9.1	-3.1	-6.6	-0.0	-10.4	-7.3	-2.9	-7.9	-0.9
0.500	9.7	4.2	-1.4	-2.6	6.3	5.9	-2.0	5.2	-1.6	3.3	-3.1
0.630	14.4	10.9	9.5	-2.9	9.3	9.6	11.2	1.3	3.4	4.6	-0.2
0.800	3.0	17.4	6.2	-9.5	-1.6	0.9	-2.6	-2.0	-4.5	-1.0	0.7
1.000	-3.9	9.9	5.4	-13.2	-7.6	1.5	-5.7	-0.9	-2.7	-4.5	0.1
1.250	-5.9	0.1	3.3	-7.3	-0.1	-0.3	-7.6	-1.3	-3.2	-1.4	0.3
1.600	-1.7	-1.4	-1.7	-9.0	-4.7	6.6	-1.2	3.2	1.9	0.4	0.3
2.000	4.4	-0.5	-0.7	-9.3	-5.0	9.3	3.3	2.2	4.3	1.6	0.4
2.500	-4.7	1.2	2.7	-6.5	-6.0	10.1	3.5	4.0	5.2	4.5	0.3
3.150	1.2	3.7	5.9	-9.6	-1.0	11.2	2.6	3.3	7.3	3.2	0.2
4.000	-4.0	-1.4	3.2	-6.4	-1.7	9.1	4.3	1.6	2.3	-3.2	0.4

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Final Report

16. Abstract

This report presents the results of an extensive experimental measurement program which evaluated the attenuation of sound for close to horizontal propagation over the ground. The measurement program was designed to replicate, under static conditions, results of the flight measurements carried out earlier by NASA at the same site (Wallops Flight Center). The program consisted of a total of 41 measurement runs of attenuation, in excess of spreading and air absorption losses, for one-third octave bands over a frequency range of 50 to 4000 Hz. Each run consisted of measurements at 10 locations up to 675 m, from a source located at nominal elevations of 2.5, 5 or 10 m over either a grassy surface or an adjacent asphalt concrete runway surface. The tests provided a total of over 8100 measurements of attenuation under conditions of low wind speed averaging about 1 m/s and, for most of the tests, a slightly positive temperature gradient, averaging about 0.3°C/m from 1.2 to 7 m. The results of the measurements are expected to provide useful experimental background for the further development of prediction models of near grazing incidence sound propagation losses.

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